

# ARCHAEOLOGY



Summer 1951

VOLUME 4 NUMBER 2

\$1.25

# ARCHAEOLOGICAL INSTITUTE OF AMERICA

Atlanta  
Baltimore  
Boston  
Chicago  
Cincinnati  
Cleveland  
Detroit  
Greensboro  
Hartford  
Iowa  
Lehigh Valley  
Lynchburg  
Madison  
Memphis  
Minnesota  
New Haven  
New York  
North Carolina  
Oberlin  
Oxford, Mississippi  
Oxford, Ohio  
Philadelphia  
Pittsburgh  
Princeton  
Providence  
Richmond  
Rochester  
St. Louis  
San Francisco  
Santa Fe  
Southern California  
Spokane  
Springfield, Ohio  
Toronto  
Walla Walla  
Washington, D. C.  
Western Massachusetts

## PUBLICATIONS

*American Journal of Archaeology*  
*Archaeology*  
*Archaeological Newsletter*  
*Bulletin*  
*Monographs*

## SOCIETIES

There are now thirty-seven local Societies of the Institute, listed at the left. Members are invited to attend the lecture meetings of the local Society most convenient to their residence.

## MEMBERSHIP—ANNUAL DUES

SUSTAINING . . . . .	\$15.00
ANNUAL . . . . .	\$10.00
STUDENT . . . . .	\$ 5.00

Sustaining Members receive all periodicals published by the Institute; Annual and Student Members receive the *Newsletter* and the *Bulletin*, and their choice of *ARCHAEOLOGY* or the *AMERICAN JOURNAL OF ARCHAEOLOGY*.

## INFORMATION

For Membership applications, specimen copies of magazines, or any other information concerning the Institute and its activities, write

THE GENERAL SECRETARY,  
ARCHAEOLOGICAL INSTITUTE OF AMERICA,  
ANDOVER HALL,  
CAMBRIDGE 38, MASSACHUSETTS.



# ARCHAEOLOGY

A MAGAZINE DEALING WITH THE ANTIQUITY OF THE WORLD

VOLUME 4, NUMBER 2 (14)

JUNE, 1951

## EDITOR

JOTHAM JOHNSON

## ASSOCIATE EDITORS

GLANVILLE DOWNEY  
CASPER J. KRAEMER, JR. (*Book Reviews*)  
J. ALDEN MASON  
GEORGE E. MYLONAS  
DOREEN CANADAY SPITZER

## EDITORIAL ADVISORY BOARD

JAMES H. BREASTED, JR.  
WALLACE E. CALDWELL  
KENNETH J. CONANT  
STERLING DOW  
CHARLES F. EDSON  
HUGH HENCKEN  
DOROTHY K. HILL  
KATHARINE JOHNSON  
SYDNEY P. NOE  
ARTHUR STANLEY RIGGS  
ROBERT L. SCRANTON  
EUGENE VANDERPOOL

## BUSINESS MANAGER

LIONEL CASSON

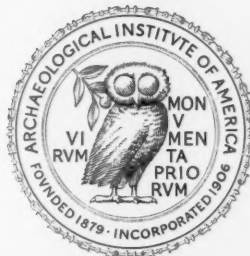
## EDITORIAL AND BUSINESS OFFICES:

ARCHAEOLOGY,  
100 WASHINGTON SQUARE, EAST,  
NEW YORK 3, N. Y.

## Summer 1951

Excavations at the Mesolithic Site of Star Carr, Yorkshire, 1949-1950, by GRAHAME CLARK .....	66
Dioramas and Archaeology, by ALEXANDER SPOEHR .....	71
Tell Time by the Stars, by JOTHAM JOHNSON .....	76
The Granite Ruin of Tonalá, by EDWIN N. FERDON, JR. ....	83
The Uncovering of Byzantine Mosaics in Hagia Sophia, by WILLIAM MACDONALD .....	89
Hagia Sophia: The Collapse of the First Dome, by WILLIAM EMERSON and ROBERT L. VAN NICE .....	94
A Silver Three-Obol Piece from Athens, by GORHAM P. STEVENS .....	104
Iznik, by CYRIL A. MANGO .....	106
A Pre-Columbian Colonization of the Amazon, by BETTY J. MEGGERS .....	110
What Is It? .....	115
University Museum Excavations in Iran, 1949 .....	116
Archaeological News .....	119
Brief Notices of Recent Books .....	123
New Books .....	128

ARCHAEOLOGY is indexed in the ART INDEX



ARCHAEOLOGY is published quarterly, in March, June, September, and December, by the ARCHAEOLOGICAL INSTITUTE OF AMERICA, Andover Hall, Cambridge 38, Massachusetts.

Subscription, \$5.00 per volume in the United States. Foreign postage, \$0.50 additional. Single numbers, \$1.25.

Copyright 1951 by the ARCHAEOLOGICAL INSTITUTE OF AMERICA. All rights reserved.

Printed by The Vermont Printing Company, Brattleboro, Vermont.

# EXCAVATIONS AT THE MESOLITHIC SITE OF STAR CARR, YORKSHIRE, 1949-1950

By Grahame Clark

*Dr. Clark is the author of Archaeology and Society, Fellow of Britain's Society of Archaeologists, University Lecturer in Archaeology at Cambridge, Honorary Editor of the Proceedings of the Prehistoric Society, and director of the excavations described in this article.*

*The illustrations are reproduced by courtesy of the British Information Services.*

THE RECENT AND STILL UNFINISHED EXCAVATIONS at Seamer, in the English county of Yorkshire, have been throwing a vivid light on the way of life of the hunter-fisher people who occupied eastern England at the beginning of the post-glacial period around nine or ten thousand years ago. The site at Star Carr is particularly suitable for investigation because it is largely incorporated in deposits which have remained permanently water-logged. This means that the processes of decay, which normally remove all traces of organic materials, have been greatly slowed down. Substances like horn and skin have disappeared, but bone and antler, together with a broad range of vegetable substances, have survived to a much greater extent than is usual in the temperate zone, except where similar conditions have obtained.

Until 1949 little was known about life in England at this remote time, except that which could be gathered from a study of flint implements and of a few isolated pieces of worked bone. Even so it had been deduced that, during the period when it was still possible to walk across the North Sea, the hunter-fisher groups occupying the whole area from east-

ern England to north Germany, Denmark, south Sweden, north Poland and as far east as Esthonia, shared a broad community of culture. After the site at Magle-

mose near Mullerup on the Danish island of Zealand, first investigated in 1900, this cultural community has been referred to as Maglemosian (Danish *Maglemose*, English "Big bog"), a name which is all the more suitable because the people concerned habitually settled by the margins of bogs at least during the dry time of the year.

## *Important Gap*

When we began to dig we expected to find a settlement of the Maglemosian culture like those from the Danish and Swedish bogs. Actually we uncovered traces of a phase in the evolution of this tradition hitherto represented only by the flint industry from Klosterlund in Jutland, dating from the pre-boreal period. The rich collection of worked antler from Seamer shows that this pre-boreal phase of the forest culture combines elements derived from Upper Palaeolithic sources with those already known from younger Mesolithic sites. The discovery thus helps to fill an important gap in the sequence of human set-



Birch trees felled by early men

On the shore of the old lake at Star Carr, Seamer, in the English county of Yorkshire, excavations recently carried out by Cambridge University students under the direction of Dr. CLARK revealed these birch trees, evidently felled by the Stone Age occupants of the site; they must be among the earliest traces of tree felling yet found. The pointed base of the larger trunk was contiguous with the southern margin of the brushwood flooring on which the people lived.



tlement in north-west Europe.

As to the site itself, our investigations have shown that the Early Mesolithic Seamer people wanted to live as close as they could to the waters of the extensive lake which at that time filled much of the Vale of Pickering. With this in view they threw down quantities of birch brushwood among the reeds bordering the lake, together with glacial stones, wads of clay and masses of discarded antlers and animal bones. No traces either of piles or of any timber superstructure were found, and it may be that the inhabitants sheltered in skin tents.

In order to learn as much as we could about the conditions under which the site was occupied, we extended our cutting well out into the deposits filling up the old lake bed. In doing so we came across birch trees felled at the time of the settlement and lying prone with their stumps at right angles to the platform. The condition of the lower extremities of the trunks, pointed like sharpened pencils, shows that the trees had been felled, and the fact that barbed antler spearheads of characteristic form were found among the branches is proof that this occurred at the time of the occupation. These birch trees must surely be among the earliest

felled by man. Flint blades of roughly chipped adzes were found on the site, together with a number of the flakes produced in sharpening them.

Among other traces of vegetable substances we found numbers of tightly wound rolls of birch bark ranging from one to eight inches wide and comprising lengths of up to thirty inches. The Lapps store birch bark in similar rolls at the present day.

#### Rude flooring at Star Carr

This oblique view of part of DR. CLARK'S excavations at Star Carr, Seamer, shows a section of the southern margin of the flooring laid down by Middle Stone Age hunters, with the glacial stones and wads of clay which helped to stabilize the birch brushwood and, in the middle foreground, the pointed base of the larger of the felled birch trees.

The scale shown is one meter in length.



Summer 1951

Geochronology	Geological Eras	Climatic Phases	Vegetation Zones	Archaeology	
500 B.C.	Post-Glacial	Sub-Atlantic	IX	Iron Age	
2,500 B.C.		Sub-boreal	VIII	Bronze Age	
5,000 B.C.		Atlantic	VII	Neolithic	
6,800 B.C.		Boreal	VI V	Ertebelle	Mesolithic
8,000 B.C.		Pre-boreal	IV	Klosterlund	
	Late Glacial	Younger Dryas	III	Lyngby Ahrensburg	Upper Palaeolithic
		Allerd	II	Bromme	
		Older Dryas	I	Hamburgian	

SIMPLIFIED DIAGRAM ILLUSTRATING THE SEQUENCE OF HUMAN SETTLEMENT IN RELATION TO CLIMATIC PHASES AND VEGETATIONAL ZONES, AS WORKED OUT BY KNUD LESSEN AND OTHERS FOR DENMARK AND SCHLESWIG-HOLSTEIN. THE SEAMER SETTLEMENT FALLS INTO ZONE IV.

It may be that the Seamer people collected birch bark so as to get birch pitch for fixing their flints in their holders, as was done by the Swiss lake-villagers. A microlithic point found in 1950 still retained much of the resin used to secure it, and this closely resembles birch pitch.



Specimen taking at Star Carr

The excavations at Star Carr, Seamer, Yorkshire, have thrown a vivid light on the way of life of the hunter-fisher people who lived there 9,000 or 10,000 years ago. In this picture a botanist, standing in high boots in the muck, is taking samples of peat to obtain pollen for analysis.

Microlithic points were among the commonest flints found on the site and were doubtless used in many cases to tip arrows for hunting.

Quantities of the bracket fungus *Fomes foetentarius* were recovered from the archaeological level. Although these were used for tinder and for other purposes by European peasants down to recent times, it is by no means proved that they were collected by the mesolithic Seamer people, since many were found still adhering to the birch brushwood, and could well have been brought in with this. The fungus today flourishes in birch woods in such countries as Norway and Scotland.

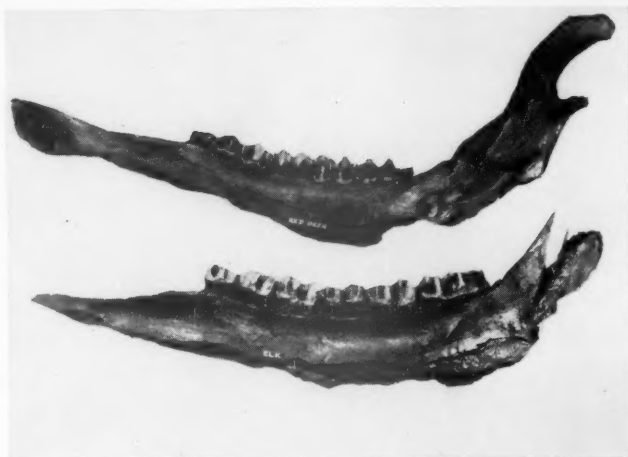
#### *Birch Identified*

It is noteworthy that every piece of wood identified from the archaeological level proved to be birch, leaves of which were also abundant. Analysis of the fossil pollen confirms that the forests at the time of the occupation were dominated by birch, though a certain amount of pine and willow may

have grown not far away in favored localities. There is no doubt that the people were living before the spread of hazel and of such warmth-demanding trees as alder, oak, elm or lime, which began in this part of the world during the full Boreal period contemporary with the classic Danish stations of the Maglemosian culture.

On the basis of DE GEER's geochronological system, Scandinavian geologists have dated the pre-boreal period at approximately 8,000 to 6,800 B.C. It is therefore of exceptional interest that the average of two Carbon 14 tests of birchwood samples from the archaeological level at Seamer, undertaken by the Institute of Nuclear Physics at Chicago, came out at  $9,488 \pm 350$  years or  $7,538 \pm 350$  B.C.

Great quantities of bone and antler were found. Much of these were apparently in perfect condition when removed from the ground, but every piece had to be treated or it would have split and disintegrated on drying. After being washed and allowed to drain off, the bones were immersed in



Deer and elk jaw bones from Star Carr

The hunter-fisher people who occupied Star Carr at the beginning of the post-glacial period hunted deer and elk for food and for the raw materials represented by their hides, teeth, bones, and antlers. By contrast with Maglemosian practice, bone was little used for implements or weapons. Of the lower jaw bones shown here, the one above from a red deer, the one below from an elk, the lower margins had been removed in order to extract the marrow.

croid and placed in a pressure chamber, from which the air was pumped. On removal the surplus croid was sponged off and the material was allowed to dry before

being packed for shipment to the laboratory for study.

The animals represented were almost exclusively forest forms. Red deer were most numerous, followed by roe deer, elk, and wild ox. Of lesser importance were wild pig, beaver, marten, fox, badger, hedgehog, hare, and possibly dog. All the birds were water-birds—red-throated diver, great crested and little grebe, red-breasted merganser, crane, and white stork.

#### *Raw Material*

By contrast with Maglemosian practice, bone was little used for implements or weapons, apart from the metapodial bones of elk, and wild ox. On the other hand, long bones were systematically broken for the extraction of marrow, and for the same reason strips were removed from the lower jaw-bones of red deer and elk. Deer antler was much used as a raw material, and every single mature specimen was worked in some way. Most commonly strips were cut from the beam by means of flint burins, the most numerous single type of flint implement from the site. This method of obtaining antler splinters suitable for spearheads and harpoons first appeared among the Magdalenian and Hamburgian reindeer hunters of Late Glacial times. On the other hand, the forms of the spearheads barbed along one edge, of which over ten dozen were found, closely resembled those made from bone, and

were widely distributed over the Maglemosian province. Deer antlers were occasionally converted into clubs, the crown and trez tine being removed and the stumps of the brow and bez tines sharpened. Tines removed from the beam were also converted into chisel-like tools.

The bases of elk antlers and adhering portions of the skull were converted into perforated mattock heads. The hole for the handle was normally driven through



Antlers of red deer from Star Carr

Dr. CLARK's excavations at Star Carr have yielded large quantities of red deer antlers, of which these specimens are representative. The majority were broken from the skull, but shed antlers were also collected. Strips have been cut from the beams of the mature antlers in order to make spear and harpoon heads.



Weapons of the chase from Star Carr

These barbed spearheads made from strips of red deer antler were among the primitive artifacts of the mesolithic settlers discovered in the excavations at Star Carr, Seamer, Yorkshire, England.

the antler at the point where it started to pal-mate. The blade was shaped from the pedicel bone and part of frontal bone so that the working edge was formed from the tougher material. Even so, it would hardly have been much good for working wood, and the implement is probably best interpreted as a mattock-head used for grubbing up roots, digging holes for traps, or the like.

After burins, and microliths, scrapers were the most numerous flint implements, and this



#### Star Carr, Seamer, Yorkshire: Excavations in progress

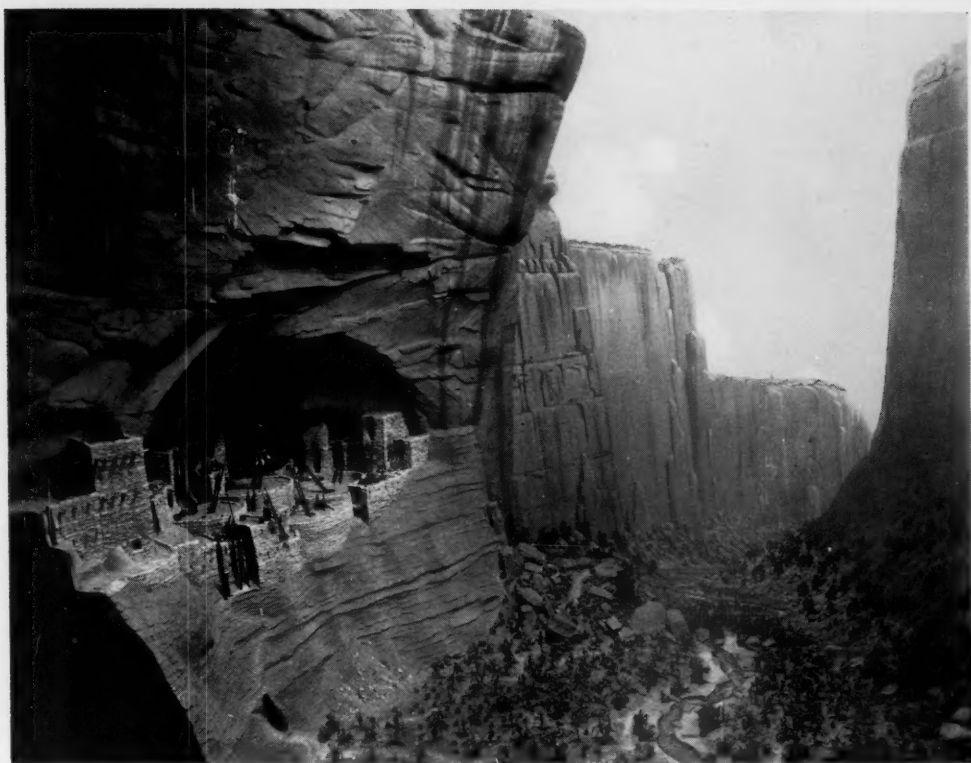
This view looks out across the old lake to the chalk wolds. In the trench at the right are students from Cambridge University, who have been taking an active part in the excavations; at the left two students, balancing on a platform slung precariously between two stepladders, are taking vertical photographs of the birch flooring. Radiocarbon tests, supported by the evidence of geology, archaeology, and palaeobotany, indicates that these people are to be dated between 9,000 and 10,000 years ago.

suggests that animal skins played an important part, possibly for tents and even boats, as well as almost certainly for clothing. Certain of the small metapodial bones of elk, improved by working, were possibly used to fasten skin cloaks. For personal adornment small stone beads were worn, as well as perforated deers' teeth and lumps of amber.

Among the most enigmatic finds were red deer frontlets with holes cut through the parietal bones. The inner portions of the burrs of the antlers were cut away and the beams and tines of these were reduced in girth to a third or so and hollowed out. What the purpose of this could have been it is hard to guess,

although it may have been intended by this means to reduce the weight of the antlers. It is possible that the frontlets were designed to be strapped to the hunter's head as a kind of hunting mask, as among the Caribou Eskimo, who are said to wear antlers on occasion to attract bulls at the mating season. Alternatively they have been worn in some kind of magic dance or rite. The famous engraving at Trois Frères in the Dordogne, southwest France, shows a sorcerer clothed in animal skins and wearing an antler head-dress. From more recent times one might cite the antler head-dresses worn by Tungu shamans, or those carried by the Horn Dancers of Abbots Bromley in the English county of Staffordshire.





Mummy Cave Village, Canyon del Muerto, Arizona

This cliff dwelling, built in a huge cave in the canyon wall of Canyon del Muerto, was occupied in the latter half of the fourteenth century (about A.D. 1253-1300), although the cave had been lived in sporadically for some 900 years prior to this time. The cave was chosen as a home because it offered shelter and could be easily defended against attack by enemies. In the canyon floor below the cave, the Indians cultivated their fields of corn, beans, squash, and minor crops. Water, firewood, and harvested crops had to be carried by hand up the precipitous path to the village. Owing to the dryness of the cave, household objects and human burials, or "mummies" (whence the name Mummy Cave), have been preserved through the centuries.

## DIORAMAS AND ARCHAEOLOGY

By Alexander Spoehr

*Curator of Oceanic Ethnology, Chicago Natural History Museum*

SEVERAL YEARS AGO, THE CHICAGO NATURAL HISTORY Museum commenced a new exhibition program in anthropology. The first project to be undertaken was the construction of a new hall of American archaeology. It had long been the desire of Dr. PAUL S. MARTIN, Chief Curator of Anthropology, to incor-

porate in such a hall a series of model dioramas. The hall—*Indians Before Columbus*—is now completed and open to the public. The dioramas have proven to be of great interest.

As a visual device in teaching archaeology, the model diorama has distinct advantages. Because it is a





#### Progress photo of work on Mummy Cave Diorama

ALFRED LEE ROWELL, Dioramist in the Department of Anthropology, Chicago Natural History Museum, is here shown constructing the miniature masonry walls of the Mummy Cave houses. The construction of each diorama in the series required months of painstaking work, wherein Mr. ROWELL combined faithful reproduction of detail with artistic requirements demanding effective and striking representation of the lives of these ancient people.

model, one can show the life of an entire community, not merely one small segment of human activity. In making the results of his research clear to the general public, the archaeologist constantly strives to present a well-rounded picture of life at a certain period in pre-historic times, and to coordinate the discrete items of knowledge of the past into a comprehensible culture pattern. The model diorama is an excellent way of ac-

complishing this aim. Furthermore, man lives in an environmental setting to which he must make a satisfactory adaptation if he is to survive. Into the model diorama can be incorporated the distinctive features of the environment of a particular people at a given time. Finally, if it is constructed properly, the diorama can punch across its lesson through its dramatic and aesthetic qualities.

It was with these considerations in mind that the museum staff planned four dioramas for the new hall of *Indians Before Columbus*. The scenes chosen were a cliff-dwelling village in Arizona, a lower Mississippi valley Indian village in Louisiana, a Maya city in Yucatan, and an Inca town in the Peruvian Andes. In selecting these scenes, the staff felt that four highly distinctive natural environments were involved, contrasting greatly with one another; and that also the cultures of

This diorama portrays a typical Indian village of the lower Mississippi Valley about A.D. 1400. The inhabitants of this village obtained their food by farming, hunting, and fishing. They made tools, weapons, and ornaments of wood, bone, stone, and shell; and from local clays they manufactured pottery, figurines, and tobacco pipes.

In the diorama, a row of thatched houses is shown at the left, with cornfields beyond. A pyramidal mound of earth and clay, surmounted by a thatched temple, surrounded by lines of human skulls set on posts, is shown at the right.

In the center foreground, a second mound is under construction. Behind this, a priest, carried on a litter, is approaching.



An Indian Village of Central Louisiana

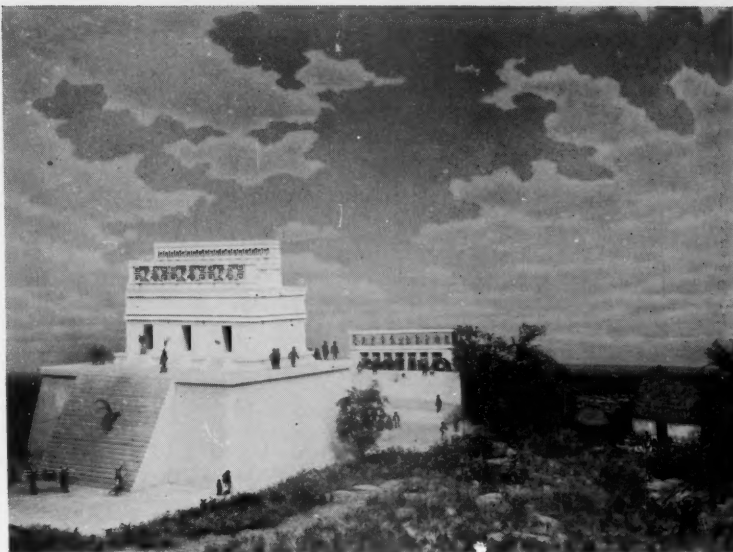
## The Maya City of Chichen Itza, Yucatan, Mexico

The ancient Maya city of Chichen Itza, part of which is shown in the diorama, is located in northern Yucatan. Chichen Itza was a religious center, consisting of stone temples and houses for priests and nobility, surrounded by the farms of the common people. The date for the diorama is about A.D. 1000.

The Maya Indians developed an elaborate architecture, expressed in stone temples and public buildings. The economic basis of Maya civilization was agriculture, the main staple crops being corn, beans, and squash grown in numerous small fields cleared in the dense jungle.

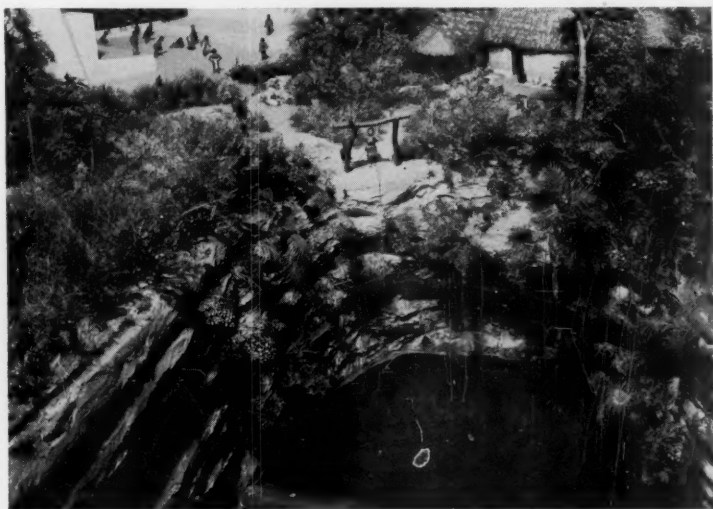
In the left foreground is shown a temple (the *Casa Colorada*), built of plastered stone masonry.

The structure behind the temple is a ball court, in which a game is in progress. To the right is a Maya house, with fields beyond. In the extreme right foreground is a *cenote*, illustrated separately below.



the peoples chosen had pronounced developments, such as the Inca system of roads, bridges, agricultural terraces, and public construction projects, that could be highlighted in each diorama. In the execution of the dioramas, great care was taken to represent correctly

and forcefully the flora, topography, and other components of the environment; to show the methods man used to adjust himself to nature; and to center attention on particular cultural achievements at the time and place depicted.



The construction of the dioramas was not done overnight. For each one, extensive planning was necessary. The execution of one from start to finish required twelve to twenty months. At least one member of the scientific staff cooperated with Mr. ALFRED LEE ROWELL, Dioramist in the Department of Anthropology, in making preliminary plans and layouts. For the Arizona cliff-dweller village, Chief Curator PAUL S. MARTIN and Assistant Curator JOHN B. RINALDO worked out the plan of exhibit with Mr. ROWELL. In the Louisiana diorama, Curator GEORGE I. QUIMBY;

*Cenote or large natural well, not visible in Maya diorama above*

The *cenotes*, or natural wells, are characteristic features of northern Yucatan and, in the absence of rivers, provided the Maya cities with a natural water supply. In the photograph, a woman is shown drawing water from a *cenote*, with a house in the right background; beyond, to the left, is the ball court with a game in progress.



Progress photograph of Maya Diorama

Mr. ROWELL demonstrates to a visitor the installation of a tree in the Maya diorama. The photograph shows the dome-shaped plaster shell in which the diorama is built.

in the Inca town, Curator DONALD COLLIER; and for the Maya city, Chief Curator MARTIN and Curator ALEXANDER SPOEHR cooperated with Mr. ROWELL. In each case, at least one of the planners had an intimate acquaintance with the actual locale shown. In addition, the problems presented by the Maya diorama made it necessary for Mr. ROWELL himself to undertake a field trip to Yucatan to obtain all the necessary material.

When preliminary plans had been completed, these were carefully criticized by the departmental staff as a whole. With the final approval of Director CLIFFORD C. GREGG and the chief curator, work on the actual construction was commenced.

The dioramas are all built within a plaster shell. The museum is fortunate in having an expert plaster technician and ceramic restorer, Mr. JOHN PLETINCKX, who constructed the shells. Following the completion of a shell, Mr. ROWELL then built in the foreground. He fabricated from plastic the various trees, shrubs, and grasses—all botanically correct—and installed the vegetation. Human and animal figures were carved in the proper shapes, sizes, and number; and temples, houses, tools, and utensils were prepared. Under Mr. ROWELL's skillful hand, bit by bit the diorama grew,

culminating in the final disguise, through painting and modeling, of the joint between the plaster shell and the modeled foreground, so that the onlooker perceives only the illusion of limitless space and distance as his eye passes over and above the horizon.

A word should also be said as to the seemingly endless library research necessary for diorama construction. Hours of reference work were required to provide the needed technical information. The characteristics of the flora; architectural details of houses and temples; forms of daily clothing, priestly costumes, and tools and utensils, all had to be painstakingly determined. In this, the museum is indebted to Mr. KARL RUPPERT of the Carnegie Institution of Washington and to Mr. RENE D'HARNONCOURT of the Museum of Modern Art for their valuable assistance.

As a final comment, it is the aim of the modern museum to be an educational institution serving a public of all ages and backgrounds. The museum's proper function is not that of a curiosity shop. Modern exhibition demands presentation of ideas, not merely stuffing more and more specimens in new cases. In the visual communication of knowledge and ideas, the model diorama is one of the most effective media.

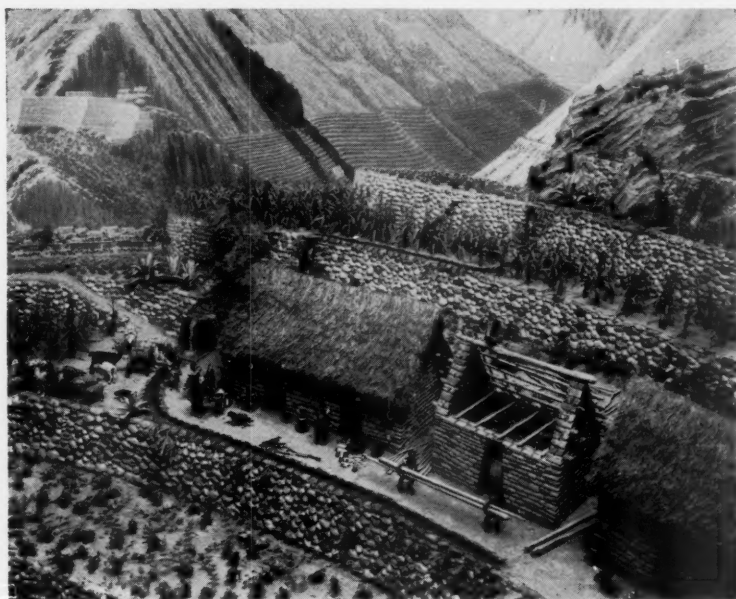
## Inca Village, Urubamba Valley, Peru

The village in this mountain valley, at an elevation of 9000 feet, is near Cuzco, capital of the Inca Empire. The date is A.D. 1450.

About A.D. 1400, the Incas, a local tribe living around Cuzco, began a remarkable series of conquests. By 1525, they had added to their empire the territory between Columbia and central Chile, a distance of nearly 3000 miles. The Inca state fell before the invasion of the Spanish in 1532.

The Incas excelled in their highly organized government and in the construction of great public works, such as roads, bridges, massive fortresses, vast systems of agricultural terraces on steep mountain slopes, and irrigation works. Many of these items of construction are illustrated in the diorama.

The village shown here is still lived in, and many terraces continue to be farmed.



### Detail of Inca Village

This photograph shows one section of the diorama of the Inca Village, Urubamba Valley, Peru.

Shown in the photograph are terraces, with irrigation ditch; corn, beans, squash, gourds, and other crops; a herd of pack llamas, with their drivers pausing for a drink of corn beer (*chicha*); women spinning llama wool and grinding corn; and a house under construction.

*Photographs by courtesy of  
the Chicago Natural  
History Museum*



# TELL TIME BY THE STARS

By Jotham Johnson

*On the Middle Euphrates lies the small Seleucid—Parthian—Roman fortress city of Dura "called by the Greeks Europolis," a city of no great shakes in its own day but celebrated in the archaeological annals of ours for the extraordinarily detailed light which its papyri, inscriptions, mural paintings, and domestic artifacts have thrown upon the Greco-Arab society of Hellenistic and Roman Mesopotamia. One of these discoveries, and the steps by which it was required to close one chink in the vast structure of the knowledge of antiquity, are described in the article which follows.*

DURA WAS FOUNDED ABOUT 300 B. C., OUTLIVED a dozen destinies, and survived until 256 A. D., when it was stormed, sacked, and left deserted by the Sasanian army of Sapor. At some moment between 300 B. C. and 256 A. D., a woman living in a private house near the center of the city gave birth to a child. This was very likely a familiar occurrence at Dura and would probably have remained undistinguished and without special interest for posterity, if it had not been for the family's reliance upon astrology. The child's horoscope, the aspect of the heavens at the moment of his birth, was cast, whether by an amateur astrologer or a professional we are not told, and someone, perhaps to assure against its being misplaced, made a permanent copy by scratching it deeply into the plaster of a courtyard wall.

It did not remain exposed even till 256 A. D., however, for at some time later the house-

holders redecorated the house. In order to prepare the wall for replastering, they took a pick and dug gouges out of the whole wall, a few inches apart; these would

help the new plaster to take a firm grip over the old. Three of these gouges struck within the area of the horoscope and obliterated a number of the letters. The replastering was then done, hiding the horoscope for centuries.

Dura was discovered and identified by the late JAMES H. BREASTED, as a consequence of chance observation by a British army captain during the Iraq War, in 1921. In 1922 and 1923 it was excavated by the famous Belgian scholar, the late FRANZ CUMONT, for the Académie des Inscriptions et Belles-Lettres. CUMONT's two volumes, published in 1926, recorded his epochal finds of parchment texts and other objects usually considered highly perishable, as well as many inscriptions. Nearly all these



Fig. 1. The first horoscope discovered at Dura-Europos (photograph reproduced by courtesy of the Yale Fine Arts Gallery).



documents were in Greek, an additional surprise in that obscure eddy of the mainstream of Hellenism.

Professor MICHAEL I. ROSTOVITZ of Yale University reasoned that where parchments had been found more might be found, and in 1928 Yale entered into partnership with the Académie to continue the excava-

ing the inscriptions which had come to light on the walls of the passageway.

ON MY WAY BACK AND FORTH between the Palmyra Gate and our camp of tents, I used to vary my path in order to study the traces of ancient buildings

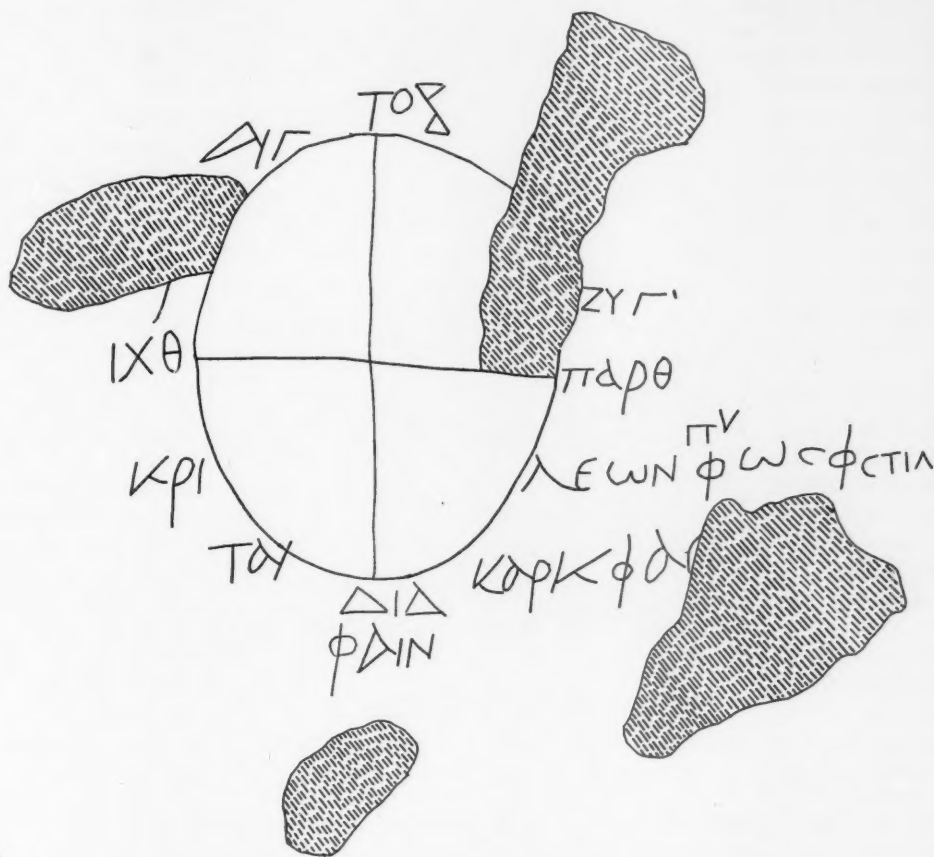


Fig. 2. Dura horoscope No. 1, traced from a penciled squeeze.

tions of Dura-Europos, a new series of ten campaigns. These campaigns were extraordinarily fruitful in the very areas of ancient culture where our deficiencies had been most lamentable, and particularly in parchments and papyri; but that is a story not to be compressed into the few pages at our disposal here.

I was a member of the staff during the first full Yale season, from October, 1928, to March, 1929. During most of the working periods I was stationed at the west gate of the city, the Palmyra Gate, keeping an eye on a hundred or so Beduin workmen and at slack times copy-

showing through the thin soil, and occasionally to pick up a coin or an interesting potsherd. I soon observed that here and there over the site private houses, or single rooms, had been more or less cursorily excavated. In looking through CUMONT's report to see what mention he had made, I found no mention of them. When I remarked this to M. PILLET, then field director of our expedition, I learned that these rooms had been dug, for diversion, by a squad of soldiers stationed at Dura to prevent clandestine digging.

These rooms, therefore, were unpublished and un-

recorded, and I took a new interest in them, because I had noticed graffiti on several of the walls and although they were in a Greek script with which I was unfamiliar I was sure that I could obtain some readings worth publishing, and perhaps gain for myself a tiny quantum of repute, or at least a bibliographical entry. I had caught the great CUMONT in an error! In one place he had read a graffito as ABIAEZHC, and since many Arab names began with *abid-* 'servant' (compare modern Abd-ullah 'Servant of Allah'), and the shape of the Greek letter *sigma* at Dura was normally C, he reported a new Semitic name, Abidezēs. But my younger eyes saw that what was carved was really ABΓΔΕΖΗΘ, the first eight letters of the Greek alphabet, and I began to foresee for J. J. a fine future in epigraphy.

So it was that I spent a holiday afternoon trying to read the graffiti of one room, very pleased when I found myself beginning to recognize some of the letters and tickled pink when I identified three or four words. They were names of foods, I remember—*lachana* 'vegetables' was one of them.

After a time I turned my attention to the next wall to the right and found myself facing the graffito which appears in FIGURES 1 and 2. The letters were Greek, all right, but they refused to form words and I could make nothing out of them beyond the general shape of an ellipse, with cross lines dividing it vertically and horizontally and written entries at twelve points corresponding to the hours on a clock face. I copied the letters and gouge marks as well as I could into my notebook, and then it was getting dark so I returned to camp.

I passed my notebook around the dinner table that evening, and a day or two later I carried squeeze paper, a brush, and a pail of water to the spot and gingerly, so as not to do any damage, made several of the paper casts which we call squeezes. One of these, as soon as it was thoroughly dry, I blacked in with a soft pencil (later, when traced with India ink, it became FIGURE 2). I

also took two photographs, with the 10 x 15 cm. plate camera which has given my friends so much amusement, but since these were not going to be developed and printed for weeks they were of no immediate use to my ambitions.

Armed with squeezes and notebook copies, I retired to my unheated tent, laced myself in, wrapped myself in a blanket, put on woolen mittens, and started to try to puzzle out this curious relic. I noticed again the division into twelve, and in trying to see how many tradi-

tional dozens in Greek mythology I could think of I got as far as the twelve gods of the Olympic pantheon, the twelve labors of Herakles, the twelve signs of the zodiac—

But what were the Greek names of the twelve signs of the zodiac? I could not remember ever having seen them, and we had no handbook except a Greek dictionary. I found it hard to remember even the Latin or the English names, but with a little reflection they began to come: Sagittarius the Archer, Aquarius the Water-Bearer, Pisces the Fishes, Aries the Ram, Taurus the Bull, Gemini the Twins . . .

Now for a few moments I made fast progress. I had already spotted *lambda epsilon omega nu* at four o'clock; this could only be *león*, Leo the Lion; at three o'clock were the letters *pi alpha rho theta*, the first four letters of *parth-enos* 'virgin,' and this was surely Virgo. At seven o'clock were a *tau* and the letters *alpha* and *upsilon* ligatured—surely *tau-ros*, Taurus the Bull. At nine o'clock were the letters *iota chi theta*, the first three letters of *ichth-yes* the Fishes. From then on it was only a matter of searching the Greek dictionary, as for the abbreviation *tau omicron xi* at twelve o'clock; of the handful of words beginning with *tox-* one was familiar as a sign of the zodiac, *tox-otes* the Archer. In like manner, two o'clock's *zyg-* turned out to be *zyg-os*, or Libra; *kark-* at five o'clock was *kark-inos*, Cancer; *did-* at six o'clock was *did-ymoi*, Gemini; *kri-* at eight o'clock was *kri-os* the Ram, Aries; and at eleven o'clock *aig-* was *aig-okeros*, Capricornus, the Goat. Two were missing

#### THE SIGNS OF THE ZODIAC

Greek	Latin	English
Toxotēs	Sagittarius	Archer
Aigokerōs	Capricornus	Goat
Hydrochoos	Aquarius	Water-pourer
Ichthyes	Pisces	Fishes
Krios	Aries	Ram
Tauros	Taurus	Bull
Didymoi	Gemini	Twins
Karkinos	Cancer	Crab
Leōn	Leo	Lion
Parthenos	Virgo	Virgin
Zygos	Libra	Scales
Skorpios	Scorpio	Scorpion

in the gouges, at one o'clock where Scorpio should have been, and at ten o'clock where Aquarius should have been; when I looked for a compound of *hydro-* 'water' the dictionary yielded *hydrochoos* 'water-pourer,' Aquarius, and behold I could see the long tail of the *rho*, just where it should be. The twelve signs of the zodiac were present or accounted for.

**B**UT I COULD NOT STOP there. I knew that the presumable purpose of assembling the signs of the zodiac would have been to arrange among them the names of the planets to form a proper horoscope. I could remember that the planets were as many as the days of the week which were named for them, seven, because to our five visible planets, Mercury, Venus, Mars, Jupiter, and Saturn, the ancients added, logically, two more bodies not fixed immovably in the sky (*planētēs* 'wanderer'), the Sun and the Moon.

I had already noticed, at four, five, and six o'clock, groups of letters beside the names of the signs of the zodiac, and these must conceal the names of planets; but when I tried to fit *Hermēs*, *Aphroditē*, *Arēs*, *Zeus*, and *Kronos* to the letters I could read I obtained no results at all. Resorting again to subterfuge, I picked out the one at six o'clock as the clearest, apparently *phi alpha iota nu*, and began running my finger down the *phain-* words in the Greek dictionary, coming almost at once on *Phain-ōn*, Shiner, the early literary name for Saturn.

At five o'clock, after the *kark-* of *karkinos*, were a *phi*, an *alpha*, and part of a third letter, which might be an *epsilon*, an *omicron*, a C-shaped *sigma*, or possibly, but probably not, another *phi*. Again the dictionary galloped up to help with *Phaethōn*, the Radiant One, Jupiter. At four o'clock, after *leōn*, were three planets: *phosph-* for *Phosphoros*, Light-bringer, Venus;

*stil-* or *stilb-* (I never knew whether I really saw the *beta* or just imagined it) was *Stilbōn*, the Gleamer, Mercury; and above, over the initial *phi* of *phōsph-*, were the letters *py-* for *Pyroeis*, the Fiery One, Mars.

That was all; the Sun and Moon are missing. But we can restore the Sun without hesitation: since the width of a sign of the zodiac is 30°, and since Mercury, by the forces that bind it to its orbit, can never be more than 28.4° from the Sun, Mercury must always be in the same sign as the Sun or in the next sign either way. It can plainly be seen that the Sun was not in Leo with Mercury, and not in

Virgo to the east of Leo; therefore it could have been only in the next sign to the west, Cancer, and must have been carried away in the large gouge along with part of the *-e-* of *Phaethōn*.

As for the Moon, there was no immediate way of checking

on its whereabouts. As far as we could then tell, it could have been lost with any of the three gouges, in Aquarius, Scorpio, or Cancer, and any assumptions we made must be based on these alternatives.



Fig. 3. The Second Dura Horoscope.

On the walls of the house of Nebuchelos were found many graffiti, including these two dimly seen copies of the horoscope of Alexander Macedon. Like the first Dura horoscope, the signs of the zodiac are abbreviated to three (or four) letters. Kronos and Aphrodite are in Scorpio, the Sun and Hermes are in Sagittarius, Zeus and Ares are in Aquarius, and the Moon is in Pisces. Between the two diagrams is a four-line graffito which has been translated "In the year 530, on the ninth of the month Audnaeus and on the fifth day of the moon, about the third hour of the day, was born Alexander Macedonius, son of Apollonicus; in the constellation of Pisces; Aquarius was rising." Like the first Dura horoscope, the Julian date was determined by DIRK BROUWER: Audnaeus 9, 530 S.E., corresponds to December 11, 218 A. D. Elsewhere in the room are five more copies of the same horoscope, each, however, containing some discrepancy.

This panel of plaster was cut out and brought to Yale. The horoscopes were published by C. B. WELLES in *Dura Report IV*, pages 105-110; and see pages 115-119 and 95. Photograph reproduced by courtesy of the Yale Fine Arts Gallery.

When I had gotten this far I realized that I could go no further without access to the reference materials in a large library, and I wrapped up my squeezes, photographs, transcripts, and notes and stored them in a safe place until my return to New Haven. But frequently in the following weeks I stopped at that wall and looked closely at the horoscope to see if I could make out any more letters. And on one such occasion there occurred an incident that might have brought my project to an abrupt halt, for as I bent forward to stare more closely at those silent scratches some object fell upon the brim of my felt hat, slithered off, flashed past my face, and landed writhing across one barefoot-sandaled foot. In the instant that it landed I saw that it was a small snake. With a wild leap I left that spot and took refuge on a mound of dirt, while the snake in turn found shelter under a pile of potsherds; but before it vanished I saw that it was a horned viper. It had been sunning on the wall above me and, exasperated by my bobbing head, had

lunged evilly at it, but had not solved the problem presented by my hat.

NOW, THE WANDERING ONES move at various apparent speeds in the sky. Since the sky is divided into 360 degrees, each of the twelve signs of the zodiac occupies  $30^\circ$ . To an observer on earth, the sun appears to move about a degree a day, and thus remains in one sign of the zodiac for about a month; but the moon takes only two days and a half to cross one sign and enter another. Mars stays in one sign for two months, or a little less, but Jupiter takes a year. Saturn takes twenty-nine and a half years to make the complete circuit, or about two years and a half in each sign.

The application of this principle, I foresaw, would make it possible to calculate the date of the horoscope. For, if we set up a perpetual sky clock, in which each planet's course along the zodiac is shown, it will be seen that particular patterns do not repeat themselves at

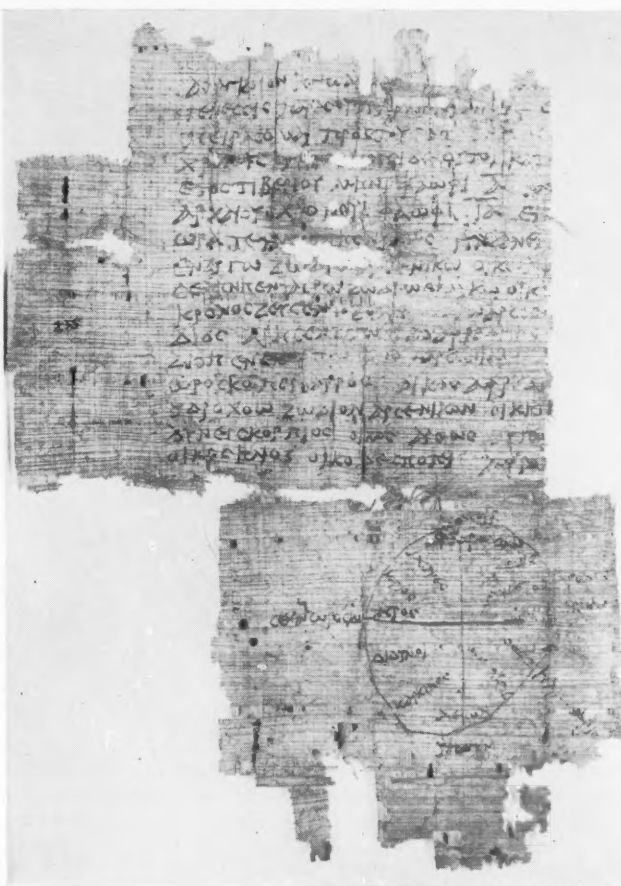


Fig. 4. A Greek horoscope on papyrus, from Roman Egypt.

This horoscope was found among the fabulous deposits of papyri from the rubbish heaps of Oxyrhynchus, and published by GRENFELL AND HUNT as *Oxyrhynchus Papyri*, Part II, No. 235. It gives a description of the heavens, written out above and shown in diagrammatic form below, a circle crossed by two diameters like the Dura horoscopes. At 12 o'clock are Aquarius and the zenith (*mesouranema*), and then in counterclockwise succession come Pisces, Aries, Taurus with the moon and the *horoskopos*, Gemini, Cancer, Leo with the nadir (*hypo gen*), Virgo, Libra with the sun and Mars, Scorpio with Mercury, Venus, and the setting

point, *dysis*, Sagittarius with Saturn and Jupiter, and Capricornus. The text gave the date, the first day of the month Phaophi of the —th year of the Roman emperor Tiberius. The year number is missing; it should be possible to obtain it from the astronomical calculation, but the astrologer who cast this horoscope unfortunately made an error in observation—perhaps more than one—which makes a precise correspondence unobtainable. Tiberius' years were 14-37 A. D., but the horoscope was probably cast between 15 and 21. Phaophi 1 was September 28. Reproduced by permission of the Cambridge University Library.



brief intervals. Having once left their starting points, Jupiter will return to Cancer in the twelfth year, but Saturn will not be in Gemini to meet him; not until 59 years have passed, five of Jupiter's revolutions and two of Saturn's, will they both return, briefly, to the same relative positions; when they do, Mars, Venus, and the Sun will non-cooperate. Actually, a set pattern will recur only after twelve hundred years or so—could have occurred only once, *if at all*, in the five and a half centuries of Dura's life.

Armed with these data and a self-assurance that, I realize now, must have been unbecoming to a youth of twenty-four, I approached Professor ERNEST W. BROWN of Yale's department of Astronomy, and asked his help in solving the arithmetical problem, posed in this form: Given Saturn in Gemini, Jupiter and the Sun in Cancer, Venus, Mars, and Mercury in Leo, and the Moon in either Aquarius, Scorpio, or Cancer, can the horoscope be dated within the limits of occupation of the city, 300 B. C. and 275 A. D.?

If Professor BROWN was overwhelmed he was too polite to show it. He accepted the papers and said mildly that he might be able to get a student to work it out. Six weeks later he sent for me and triumphantly spread the answers before me. DIRK BROUWER, a research assistant, had done the problem as an exercise. The date of the horoscope was July, 176 A. D. Not only that, but it could be fixed within two two-and-a-half-day periods: July 3 to 5 if the Moon was in Scorpio, July 10 to 12 if the moon was in Aquarius. (The third possibility, that the Moon was in Cancer, was ruled out; in that circumstance the other relations would not hold.)

This was very handy, an archaeological document dated within ten days, and fixed permanently to the wall of a house, which too acquired a date by the association. I thanked Professor BROWN as fervently as I knew how, bowed myself out, and returned to my writing-place in the corner of Professor ROSTOVITZEFF's office. ROSTY was pleased too, he said. As for Dr. BROUWER, he rose to be Professor of Astronomy, chairman of the department of Astronomy, and director of Yale's observatory, titles he holds today.

AT THIS POINT we must turn back to FIGURE 1. Above the horoscope and to the left, at the very edge of the photograph, were some more letters. We had not paid much attention to them—they did not even appear on the squeezes or in my notebook—and with the horoscope in Mesopotamia and me in Connecticut we were going to have to use the photo-

graph or nothing. With the aid of a lens we succeeded in making out seven letters, ZHYYIIANΘ. We did not know that they belonged with the horoscope—there were reasons for thinking that they did not; but when we found out what they were, *zeta pi upsilon pi alpha nu theta*, it seemed unlikely that they would ever be linked to anything. *Zpypanth*. Strange as some Greek words sound, this would not have meant anything, even to a Greek.

However, it presently occurred to us that it might be a date. The Greeks used letters for numerals. The first three letters might be numerals for the year, the second three the name of a month in abbreviation, the last letter the numeral for the day, just as I might write 951APR9 for today. In that case the year numerals would be

<i>zeta</i>	7
<i>pi</i>	80
<i>upsilon</i>	400
	— 487,

the 487th year in some one of the eras by which the despots of western Asia counted time. At Dura, under Roman occupation, we would expect dates to be by the Roman emperors; but before the Romans annexed Dura, the era in use had been the Seleucid Era, whose year 1 ran from September, 312 B. C., to September, 311 B. C. If that was the era in use here, the year 487 would have run from September, 175, to September, 176 A. D.

We had a feeling that we were very warm.

This was heightened when we hunted up a list of month names. The other texts at Dura—those few that bothered to mention the months—had shown the Macedonian months in use. Of these, only one began with Pan-; this was Panemos, and it corresponded to July!

But the day did not fit; *theta* stands for 9, and whether or not Panemos was equivalent to July, Panemos 9 would not fit either alternative for the Moon in the horoscope, July 3—5 or July 10—12. Even with the Seleucid Era in use, we would have expected to find the Julian calendar controlling at least the months, and the refusal of Panemos 9 to cooperate was provoking.

But there was one more possibility: that the Romans had not, not yet at Dura at any rate, outlawed the former Macedonian *lunar* calendar. In that case, the months would have begun with the new moon, the first appearance of the slender crescent in the sunset sky. In that case, Panemos 9 would have been the ninth day of the month that had begun with the previous new moon.



Earlier in the century a German scholar named GINZEL had published a three-volume *Handbuch der mathematischen und technischen Chronologie*, and in this he had included a handy list of the dates of new moons, as seen from Babylon. With trembling fingers I found the new moons for 176 A. D.—April, May, June—June 24, at 9.56 A. M. A momentary frustration: If June 24 was Panemos 1, Panemos 9 would be July 2, another bad fit.

But the month depended on actual observation of the new moon; GINZEL's decimals gave astronomical new moon, and a human observer, unaided, could not have seen the too-thin crescent on the evening of June 24; Panemos would have had to wait until the evening of the following day to start, and consequently Panemos 1 would have run from sunset, June 25, to sunset, June 26. Eight days later, Panemos 9 would have run from sunset, July 3, to sunset, July 4. The correspondence between the two systems of dating, Seleucid and Julian, was complete and perfect.

WE DID NOT SOAK UP all the implications of this at once. For a little while it looked much too good to be true; but gradually we took heart. We even found that we could fix the time a little more closely still, because the horizontal diameter is the

*hōroskopos* proper, the line that indicates the horizon; the sun, in Cancer, is well below the western horizon, approaching midnight. The baby whose birth was thus memorably noted was born about ten P. M., and that was on July 3, since Panemos 9, as we saw, ran from sunset, July 3, to sunset, July 4, or July 3/4 as we write it. This is about as close as we ever expect to date any ancient document, except another horoscope.

It was of some interest, too, to recall again that at Dura in 176 A. D., under Roman occupation, the Seleucid Era, the Macedonian month names, and some form of lunar calendar were all still in use. This raised the conjecture that we might use this new and isolated correspondence between the Seleucid and Julian calendars,

Panemos 9, 487 S.E. = July 3/4, 176 A.D.,

to show one of the Hellenistic lunar calendar cycles still in belated operation, perhaps the famous Babylonian cycle. Later we tried it, and to our amazement succeeded in doing just that; but that is another episode, a matter of many hundreds of hours more thinking, and figuring, and thinking again, until we ended up with the solution that could not be upset. I have told a little fragment of that story somewhere else; I cannot start it here.



The ancient builders of Tonalá were forced to level the tops of mountain spurs to obtain flat surfaces for their buildings, courts, and plazas.

## THE GRANITE RUIN OF TONALÁ

By Edwin N. Ferdon, Jr.

*A native of St. Paul, Minnesota, Mr. Ferdon has excavated in New Mexico and Ecuador, and explored in Peru, Bolivia, Mexico, and Guatemala. In 1944-45 he was with the U. S. Cinchona Mission in Ecuador. Between trips he graduated from the University of New Mexico (B.A., 1937) and the University of Southern California (M.A., 1943). At present he is Research Associate at the Museum of New Mexico, Santa Fe.*

A LONE RIDER PUSHING HIS HORSE A STEP FASTER emerged from the mouth of the Río Tehuantepec canyon and caught the first moist breath of ocean air as he rode out onto the plains of the Isthmus of Tehuantepec. His face was tanned in the extreme and his lips were deeply cracked from the hot, dry air that had surrounded him ever since he had dropped off the high plateau just south of Mitla and begun the tortuous descent into the twisting canyons that led him southward toward Tehuantepec.

It had been a long and arduous trip from Santa Fe, New Mexico, south through Chihuahua, into the Tarahumara Indian country, and on to the Tarascan territory. The

route was a wide and dusty trail, or, again, a narrow twisting pathway up the side wall of a canyon. Home was where he found it, on the ground with the sky as a cover, or perhaps an Indian's hut with *pinole* and a little dried meat to eat. Leaving the Tarascan country, the trail had led east to Mexico City and then on to

Oaxaca and the ancient temples of Monte Alban and Mitla. Then had come this final trek down to the hot coast and on to the granite ruin of Tonalá.

A brief stay at Tonalá and horse and rider turned about to hit the long trail back to Santa Fe. There were no autos, no paved roads, no convenient airlines to help this saddle-weary traveler. Of



hospitality there was an abundance, but good hotels with clean beds and fine food, well, perhaps a few. This was the year 1906, and the rider was Dr. EDGAR L. HEWETT, making a reconnaissance for the AR-

situation by constructing a paved road south to Tehuantepec and thence along the coast and over the *sierra* to Tuxtla Gutierrez in the cool highlands of Chiapas. Facilities had not kept up with the road crews, so that when I left Oaxaca and headed south it was with the knowledge that there would be neither gasoline station nor garage until I reached Tehuantepec 150 miles and four hours away.

From Tehuantepec south there was only about thirty miles of dirt road which was rapidly disappearing as men and machines laid down gravel and tar in wide, smooth layers. After climbing into the Chiapas highlands, my route took me south over the edge of the plateau and down again to the coastal plain at the little railroad town of Arriaga. From this point on, two sandy ruts guided my car into the freshly-renovated plaza of Tonalá.

The trip was certainly not difficult, and had it not been for my desire to see new areas of Mexico, I could have gone by railroad directly to Tonalá. An even quicker method would have been to fly to Itepec,

a railroad center just north of Tehuantepec, and catch a train from there.

Tonalá, with its lovely plaza, is very much a rural settlement serving the big and little cattle growers of the region. Several miles away along the ocean front are a few fisher folk who do a little business selling sun-dried fish and roe. So common, in fact, are these dried

fish eggs that when one goes to the open market and asks for a hen's egg by the customary Spanish word, *buevo*, he is more apt than not to be given a package of dry fish roe.

Being off the beaten path of business, Tonalá has only a large, barracks-like building to accommodate its guests. I refrain from using the word "hotel" in describing this aging structure, which may well have been in



Three Tonalá terraces are faced with a decorative veneer of dressed granite blocks and slabs. Here we see the largest of these decorated terrace facings with a centrally placed paved ramp leading to a ruined platform mound on the upper level.

#### CHAEOLOGICAL INSTITUTE OF AMERICA.

Forty-three years later, in 1949, I left Santa Fe, New Mexico to complete an archaeological survey of Tonalá begun in 1937 under the aegis of this same Dr. HEWETT. Instead of a few thousand miles of dusty trail with saddle leather beneath me, I had a comfortable automobile with sixty-five horses all neatly tied up in the form of a compact motor. My route from Santa Fe to Laredo and down through Mexico to Oaxaca was over well-paved roads. My evening stops were at comfortable hotels with good food and clean beds. I was even given the choice of Mexican or American coffee, the former being the concentrate which is added to hot water or milk in any desired strength, the latter the industrialized powdered product so common on our store shelves.

**I**N 1949 OAXACA could be termed a frontier for the American motoring tourist. The Mexican government was remedying this

This end view of a decorated terrace facing clearly illustrates the manner of masonry veneering employed by the ancient builders of Tonalá



use when HEWETT reached Tonalá in 1906. My barn of a room was furnished with a small bed, and a wash-basin of doubtful vintage rested against one wall. When evening came, I found that I was not alone when half a dozen bats, loosening their hold on the beams above my head, went chirping out the window.

It was with considerable joy that I finally found an old friend, DON CASIANO SALAZAR, the owner of Tonalá ruin. He immediately arranged for horses to take me up the mountain to his site, and offered the shade of his ranch trees as shelter for my car.

The land surrounding the ruin of Tonalá has long been used as a cattle range and there, in the midst of ancient temples, stood a little mud house, the portal of which became my home for the next month or so. My meals at this *ranchito* were indeed simple, consisting of coffee, a little bread from time to time, and the ever present beans and tortillas. Our daily ration of meat was limited to a few solid morsels of sun-dried jerky, except occasionally when DON CASIANO rode up the mountain with a slab of fresh meat carefully packed in his saddle bag. As a special treat, he brought *buevos* or dried fish roe.

In a few days we had rounded up several *macheteros*, those men who wield a machete with the precision of a swordsman, and the survey of Tonalá was underway.



A granite, slab-faced platform at Tonalá has a broad stairway built against the edge of the mound. A two-room temple once stood on top of the platform, but its walls have now all but weathered away.



This long rectangular platform with dressed stone facing is surmounted by a much smaller secondary platform edged with coarse masonry. On top of this latter are the low wall remains of a one-room, three-doorway temple building.

As brush and trees fell before the sharp steel, other men followed to clear out the grass and short stubble that grew between the ancient hand-hewn stones. At long last, the major temples and platforms lay clean and bare, ready for studying and photographing.

Cleaned of its covering of brush and trees, Tonalá is a simple, yet impressive site. Located about twelve kilometers from the town of Tonalá, it is beautifully situated on the lofty crest of a granite ridge which springs from the Pacific coastal plain and forms, in effect, the foothills of the main Sierra Madre de Chiapas. Here primitive architectural remains cover the upper portions of four spurs that jut southward from the top of the ridge. This is rough savanna country, and the primitive architects who designed the layout of this ancient temple area were forced to cut and fill the tops of these spurs in order to form large, artificial terraces upon which their sacred temples and platforms could be built.

Architecturally the ruin cannot compare in magnificence to such splendid Maya ruins as Uaxactun or Tikal or, for that matter, to the great Zapotec site of Monte Alban. However, the early Tonalteca did excel in working the hard, native granite into well fitting masonry blocks and slabs, some of them of considerable size and weight. These were used as facing veneer for temple platforms and for decorative



surfacing against the sloping edges of some terraces. But not all Tonalá masonry shows this fine craftsmanship, roughly shaped blocks and rubble being equally



A large Olmec-like jaguar head with hollowed out eyes is outlined on the side of a large boulder located in one of the principal plazas of the ruin. Biconical holes have been drilled at each side of the head and at the point of the chin, possibly for the attachment of some sort of decorative or ceremonial paraphernalia.

common as building material.

During the 1949 survey of this site, conducted by the School of American Research with the aid of a Viking Fund grant, no evidence could be found that the ancients of Tonalá either knew or used lime plaster or cement, though it is possible that such material has long ago washed off the exposed walls and, if present, would come to light upon excavation. However, most of the fitted stone work appears to be dry laid, a technique brought to perfection by the Incas of Peru. Rougher forms of masonry are laid up with only a small amount of mud as a binding material.

Architectural features at Tonalá are quite simple, consisting, for the most part, of various superimposed

platform elements upon which are built one- or two-room temples having either a single or triple doorway. In the latter case the doorways are separated from one another by rectangular masonry piers. In one of the temples there is evidence of a small shrine or sanctuary room built against the back wall and reminiscent, in floor plan, of the shrine room in the temple of the Foliated Cross at Palenque.

Platform stairways at this ruin rise at a relatively low angle and are characterized by having a reasonably wide tread. This is in contrast to the many high-angled, narrow-treaded stairways so common at many Meso-American ruins. However, the general lack of stairway balustrades, as at Tonalá, is also encountered at the Peten Maya ruin of Uaxactun.

A typical feature of Tonalá that does not appear to be very common at other Mexican and Guatemalan ruins is the use of numerous flagstone paved ramps as a means of communication from one terrace level to another. The use of the ramp is a widely distributed trait. It has been found as a part of platform mounds in the eastern United States and also appears as a feature of certain mounds on the coast of Peru and

in the highlands of northern Ecuador. It may well be a very old architectural feature in the Americas.

Matching the simple construction features at Tonalá are a few decorative elements, such as simple apron-moldings and notched platform corners, that served to embellish these structures. Decorative carving is noticeably absent. In its place, however, the primitive architects seem to have used



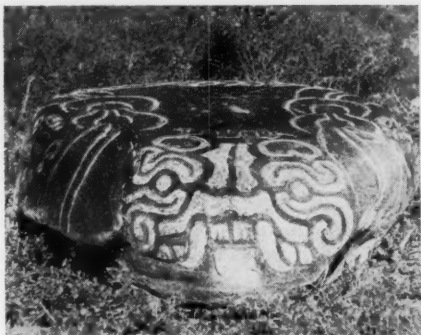
This reclining figure is formed by shallow grooving on the side of a boulder. The figure above the head may represent some sort of glyph. One can almost imagine that this is a caricature of the foreman whose crew originally built the site.

their well dressed granite blocks and slabs as a means of enhancing the appearance of their structures, giving them a feeling of massiveness and strength.

Whereas stone carving is lacking as architectural em-



The rancher at Tonalá refers to this monument as La Cachucha because of its resemblance to a man's cap. The jaguar-like monster is outlined on the boulder by means of both grooves and slightly raised lines. The back of the rock is decorated with two rampant serpents tied together by a knotted cord.



Directly in front of the stairway of a projecting platform is this altar carved in low relief. One end of the monument is decorated with the jaguar head illustrated here, while a well executed human face is carved on each of the other three sides of the altar.

Here is one of three low-relief human heads carved on the altar illustrated in the previous figure. Knotted cords carved in the rock above each of the heads leaves the impression of a neatly-tied package or ceremonial bundle.



This simply carved head probably represents the god Tlaloc. The median crest extending back from the forehead is a feature found on sculptured figures at La Venta as well as on certain Olmec figures.

bellishment, it is found on a number of individual stone monuments. Working in a hard granite rock, it is not surprising that all these specimens of sculpture are in relatively low relief. Some consist of nothing more than slightly raised, or lowered, i.e., grooved, lines depicting the features of a pattern. Along with the examples of stone sculpturing are a number of plain, roughed out, or smoothed, stelae, and a few rectangular and discoidal altars. It is possible that some, if not all, of the smoothed

stelae once bore painted decoration or glyphs.

Just where Tonalá stands as regard to exact period of occupation, and to what prehistoric culture group it belongs, cannot be definitely stated at this time. The architecture would appear to fall within the Maya early Classic period. Temple floor plans and the stelae and altar complex are of Maya tradition. However, some of the sculptured monuments seem to have been influenced by the so-called Olmec art forms. Only future excavation can answer a few of the many questions that Tonalá brings to mind.

The only carved stela yet found at Tonalá is this specimen, locally referred to as El Soldado, located along the trail leading to the ruin. The one face shown here exhibits the lower two-thirds of a human figure whose left hand holds a knife and right hand a shaft, possibly a spear. An Olmec head pendant rests on the chest of the figure. The opposite face of the stela also depicts a human figure, while the two edges, one now badly scaled, appear to have carved, non-Maya glyphs.



A partly toppled plain stela and a discoidal altar stand at the top of a paved causeway that leads down the mountain ridge toward the coastal plain



# THE UNCOVERING OF BYZANTINE MOSAICS IN HAGIA SOPHIA

By William MacDonald

*The Byzantine Institute, Inc.*

## Hagia Sophia

A general view of four niches in the north tympanum wall of Hagia Sophia. Turkish paint and plaster cover Byzantine mosaics because the Moslem religion forbids the representation of the human figure, and Hagia Sophia was a mosque from 1453 until 1932, when it was made into a museum. The location of many of the mosaics is known through reports of nineteenth century observers who were able to survey the building during a period of extensive repairs. Incisions made to determine the accuracy of these reports can be seen in the two niches to the left. Mosaic was found and elaborate scaffolding was then put into position.



Niches in the north tympanum wall

*This sequence of photographs shows the uncovering and cleaning of a Byzantine mosaic portrait of Saint John Chrysostom, the "Golden-tongued." Saint John was made Patriarch of Constantinople in A.D. 398, but this portrait was not executed until the ninth century, during the Second Golden Age of Byzantine art. The portrait stands high on the north tympanum wall of the Great Church of Hagia Sophia in Istanbul, and was uncovered, cleaned, and consolidated by the Byzantine Institute, Inc., during 1940. The cover of this issue shows the head of Chrysostom reproduced for the first time in full color.*

*For further pictures of Hagia Sophia and sidelights on its chequered fortunes, see the article by Messrs. Emerson and Van Nice on pages 94-103.*

## Hagia Sophia: Close-up of a recess

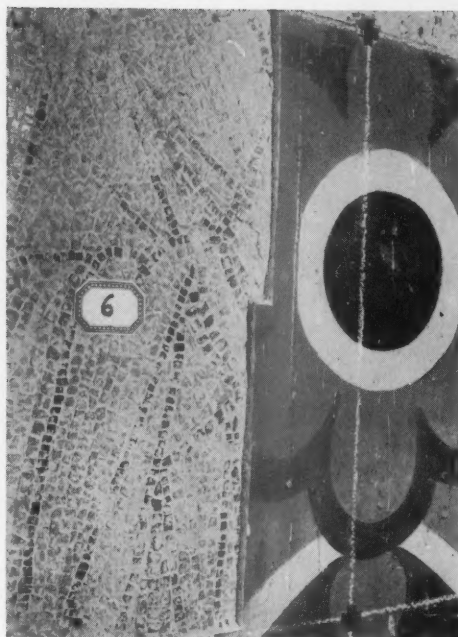
A close-up of the recess believed to contain the mosaic portrait of Saint John. Incisions have been made through the Turkish overpainting and through the heavy plaster coating, revealing mosaic throughout the niche.





**Hagia Sophia: Cleaning is begun**

Above, a grid has been marked over the niche in order to facilitate scholarly recording and work schedules. In five sections and part of a sixth the plaster over-coat has been removed, revealing the head of the image and letters of the name, Iōannēs.



Right, a close-up of section six shows the thickness of the plaster coat and the uncovered but as yet uncleaned tessellae.

### **Hagia Sophia: Scaffolding**

A general view of the work platform of the scaffolding, showing two niches being worked on simultaneously. To the right a mosaic portrait of Ignatios Theophoros is beginning to appear. Scaffolding was slung out of the tympanum windows, over a hundred feet from the pavement, and was reached by a route which took the technicians outside along the roofing.







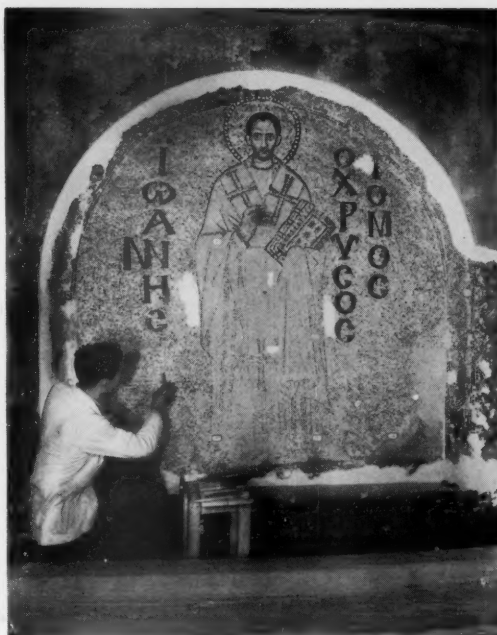
The white patches are areas of consolidation. No restoration of mosaic is undertaken by the Byzantine Institute, but where tessellae have fallen out, or where the mosaic has begun to leave the fabric of the building (through the action of earthquakes or improper drainage), copper cramps and plaster are used to consolidate and preserve these marvelous works of art.

# Hagia Sophia: Consolidation and cleaning



Above, right, a technician at work. The laborious and tedious job of cleaning each tessella has begun. The surface and edges of each cube must be carefully cleaned, as well as the all-important interstices between individual cubes. Whereas the heavy plaster over-coat is removed by the gentle and judicious use of chisels, the later stages of the work are carried on with delicate dental tools and brushes of the very finest quality. No solvents, liquids, or chemicals of any kind are used.

Saint John begins to appear more clearly. He wears a robe of ivory white and carries a jeweled Book of the Gospel executed in brilliant colors. The background is shimmering gold, sensitive to each movement of the sun, accentuated by a sprinkling of silver and darker tessellae and by the softly undulating surface of the wall.



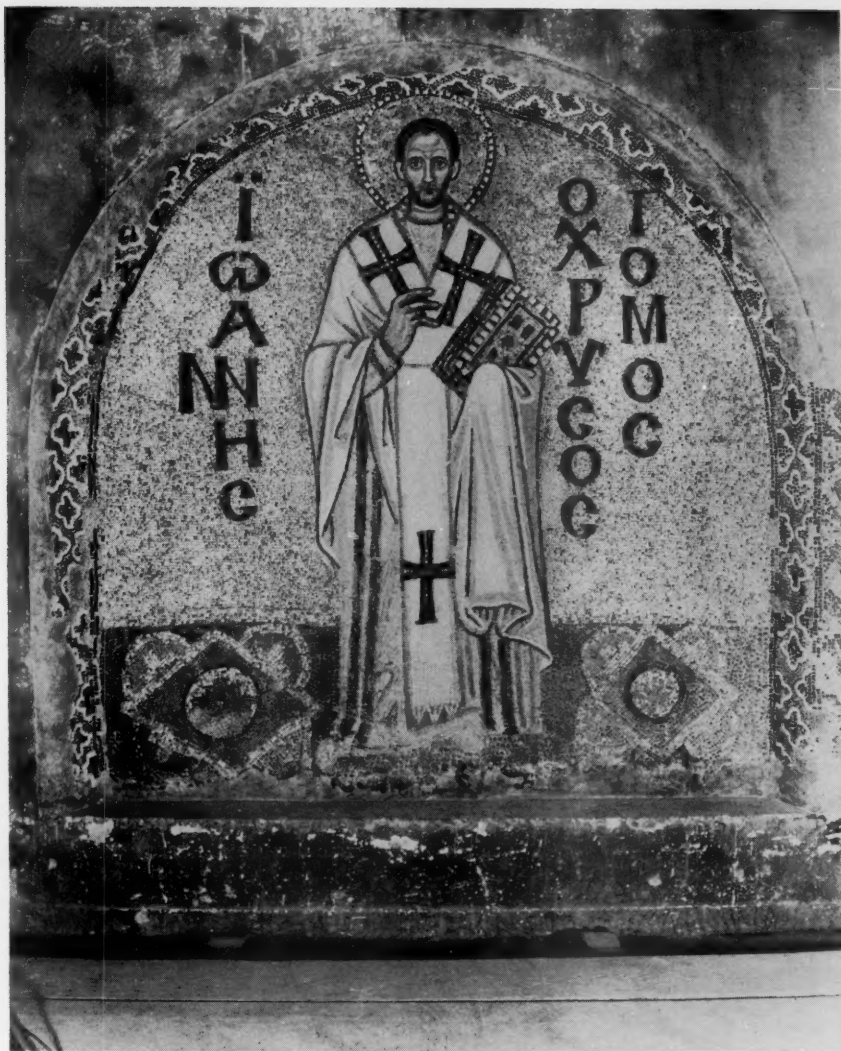


### Hagia Sophia: Work on two niches nears completion

Nearly five hundred years after the Turkish conquest of Constantinople, Saint John and Saint Ignatios stand revealed again.

The portrait of Saint John Chrysostom, now completely cleaned and consolidated, needs only to have its areas of blank new plaster toned down.





### Hagia Sophia: The Portrait of Saint John Chrysostom

The portrait of Chrysostom, brought back almost to its original state, indicates the beauty of Byzantine mosaic painting as it was practised during the greatest days of the Empire. The name of the artist, as is commonly the case in Byzantine art, is not known; the late THOMAS WHITTEMORE, the founder of the Byzantine Institute, thought it possible that a group of men worked on each panel "in orchestral anonymity." For a detail of the head in full color, showing the individual tessellae, see the front cover of this issue of *ARCHAEOLOGY*.

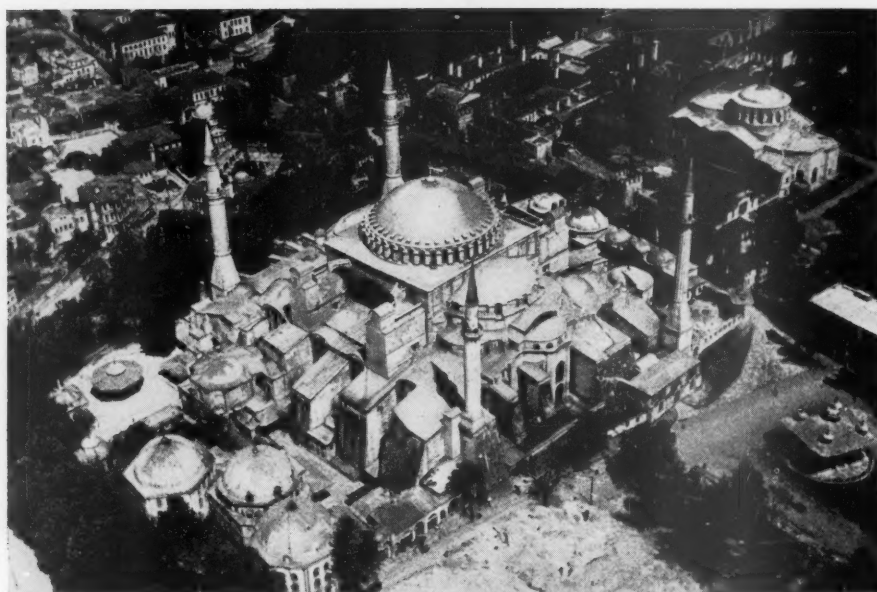


Fig. 1. Hagia Sophia. From the air, with the southeast corner in the foreground (Photograph by Sabah)

# HAGIA SOPHIA

## THE COLLAPSE OF THE FIRST DOME

By William Emerson and Robert L. Van Nice

*William Emerson is a native of New York and a graduate of Harvard University; from 1919 to 1939 he was Dean of the School of Architecture at the Massachusetts Institute of Technology. He is President of the American Association for the United Nations, and also of the Unitarian Service Committee.*

*Robert L. Van Nice, of Portland, Oregon, is a graduate of the University of Oregon and of the Massachusetts Institute of Technology. Except during the war, when he worked first on oil refinery designs and then overseas on government service, he has worked on Hagia Sophia since 1937. His present title is Visiting Research Associate at Dumbarton Oaks Research Library and Collection. At the moment, he is at Hagia Sophia, in Istanbul, Turkey.*

THE HISTORICAL INTEREST SURROUNDING HAGIA Sophia as the center, at various times, of three different religious rites has added a fourth dimension to the building's architectural distinction. Following its dedication by Justinian in December, 537 A.D., the church served the Orthodox rites for a period of nearly seven hundred years. After the Latin conquest of 1204 it became for fifty-seven years a Roman Catholic cathedral. Upon its recapture in 1260 Greek services were resumed for another two hundred years, and after the

conquest of Constantinople by the Turks, in 1453, it served as a Mohammedan mosque for nearly five centuries. In 1935 it was secularized by the Turkish Republic and is today a state museum. The unique position of Hagia Sophia among historic monuments is widely known from documentary sources relating to the three empires with which its fate has been closely associated during more than fourteen hundred years of continuous use.

The dimensions of the physical structure, on the



other hand, are known largely in general terms: that for its first thousand years, for example, until surpassed in size (but not in magnificence) by the Cathedral of Seville, it was the largest church in the world, and is exceeded now by only three; that its immense dome, which today remains the third largest, was constructed on an ingenious system of supports never previously tested at so large a scale; that in spite of this and other deviations from tradition, and especially its unprecedented size, the church was successfully completed within a single building campaign lasting less than six years; and that, after suffering serious injury from three major earthquakes and surviving more than eleven hundred others of varying magnitudes, as well as the effects of time, decay, and intermittent neglect, it reaches us not as a lifeless derelict but with much of its original decoration intact and its structure sound. It is therefore all the more paradoxical that relatively little precise information is at present available concerning a monument of such unusual architectural importance.

The scarcity of reliable information results in part from the reluctance of the Turks, during the centuries immediately following their conquest, to permit the building to be closely examined, even though entry was allowed for casual or official visits. Under these conditions what little information reached western scholars came largely from the descriptions of travelers, the best-known of which is the illustrated account by GRELOT, a Frenchman who in the seventeenth century gained access to the mosque in disguise. It was not until the middle of the nineteenth century that legends and misconceptions inspired by these early reports began to be dispelled when, in 1847, SULTAN ABDUL MEJID opened the way for closer examination of the building by commissioning the FOSSATI brothers, two Italo-Swiss architects, to make a thorough restoration. The presence of the FOSSATI enabled the King of Prussia to introduce SALZENBERG, a German architect, for

the purpose of making an archaeological study while the interior was full of scaffolding and much of the fabric exposed. Though he probably saw much more of the actual structure than is visible today, his *Altchristliche Baudenkmäler von Constantinopel vom V bis XII Jahrhundert* contains only a general description illustrated for the most part by conventional drawings. Since its appearance several studies of the building as a whole and numerous shorter ones treating limited features have been published, but these have had to rely heavily on SALZENBERG because relatively little new information has been assembled in the last hundred years.



Fig. 2. Hagia Sophia from the southeast corner, with the apse at the right.

The secularization of the mosque, in 1935, created circumstances favorable for recording, within the framework of a transit survey, the hitherto unavailable evidence contained in the existing structure. Even though the data assembled during investigations lasting several years are still being assessed, it is now possible to suggest, as we shall in a sub-

sequent article, a number of the problems which had to be surmounted in later repairs, and to tell here the slowly emerging story of the collapse, only twenty years after its completion, of Hagia Sophia's original dome.

HAGIA SOPHIA IS THE THIRD CHURCH dedicated to Divine Wisdom to occupy the present site, both earlier ones having been burned by mobs, the second during the Nika riots of January, 532. These disorders, which broke out as a result of a decision in sporting events in the hippodrome unfavorable to one of the opposing political factions, nearly cost Justinian his throne and ended in the destruction of much of the ancient center of the city. While viewing the ruins shortly thereafter Justinian decided to build a new and larger church; and work on it was begun, according to contemporary accounts, on the fortieth day after the disaster. Whether plans for such an ambitious undertaking

had already been considered or were begun at that moment is not clear, but it is certain that Justinian's architects, Anthemius of Tralles and Isidorus of Miletus, pushed forward the construction so rapidly that the im-

dorus the Younger, a nephew of one of the original architects. Though the actual form of the first dome can only be conjectured from meager descriptions, Isidorus the Younger is reported to have built an entirely new dome with a crown some 6.25 m. higher than that of its predecessor. It is this second dome which stands today. In Byzantine times it was twice injured by earthquakes and repaired within precisely dated periods: in the tenth century the western arch and a segment of the dome came down and were replaced by Trdat, an Armenian architect; in the fourteenth century the eastern arch and a part of the dome gave way and were repaired under the supervision, apparently, of two local architects, Astras and Faciolatus, and an Italian, Giovanni Peralta. The five hundred years of Turkish proprietorship saw, so far as we know, no further collapses, though substantial consolidations of the fabric were carried out in the sixteenth century



Fig. 3. Hagia Sophia. From the southwest.

mense building, despite threatened failures in the course of the work, was successfully completed within five years and ten months, and it was dedicated on December 26, 537.

The unfortunate results of processes that must thereupon have begun to affect the structure are told in surviving accounts by Procopius, Paul the Silentary, Evagrius and Agathias, all of whom wrote within the lifetime of men who may have either witnessed or participated in the initial construction. From their accounts we learn that the church was shaken by a severe earthquake in August, 553, that the eastern arch of the four which carry the dome was damaged by a second earthquake, in December, 557, and that six months later the eastern arch and a segment of the dome came down.

Justinian then entrusted the necessary repairs to Isi-

and again a hundred years ago.

Thus the structure we have today is not an anonymous legacy from the past, for it embodies, in addition to repairs of the fourteenth and tenth centuries, the second dome of Isidorus the Younger which stands on supports originally designed by Anthemius and Isidorus. It is from evidence contained in these elements, such as the characteristics of their materials and the deformations they have undergone, together with estimates of the magnitude and probable effect of the forces

at work in them, that various causes of the collapse of the first dome can be inferred.



Fig. 4. Hagia Sophia. West facade.

AN INSIGHT into the magnitude of operations demanded by Hagia Sophia's great size, not only during the initial construction but also in later attempts at repair, is best conveyed by a view from the air (FIGURE 1). Here,

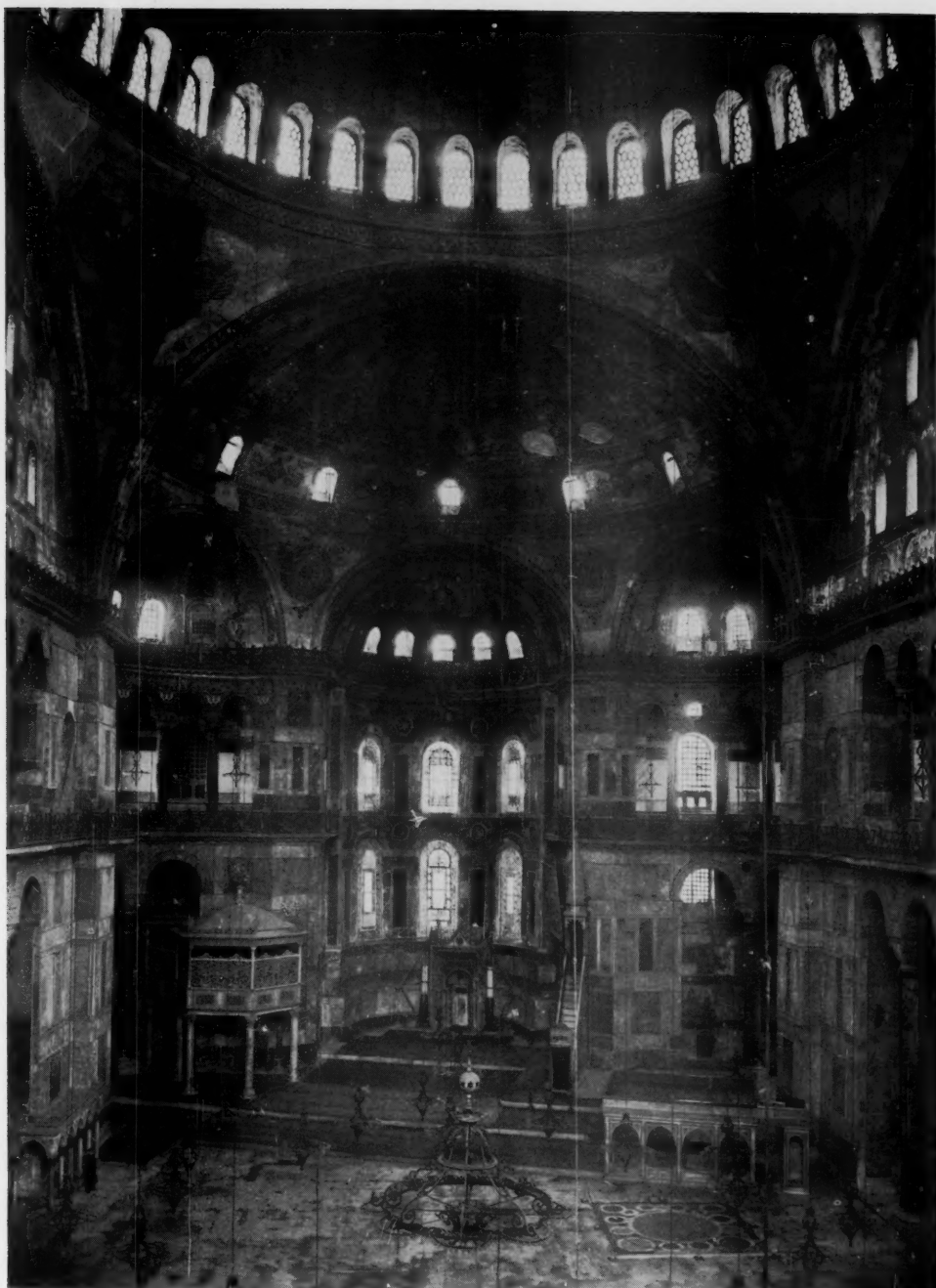


Fig. 5. Hagia Sophia. Nave, from the center of the west gallery, the place reputedly reserved for the Byzantine empress. (From a negative in the archives of the Archaeological Museum, Istanbul)

with the southeast corner in the foreground and the apse at the right, become apparent the immense area covered by the building, the volume of the central mass out of which the dome rises, the number and bulk of low buttresses that have in later times been thrown against the peripheral walls, the minarets added at the four corners by the Turks, and the numerous subsidiary buildings, both Byzantine and Turkish, that have grown up nearby. A view of the same corner from the ground (FIGURE 2) shows the manner in which the semidomes build up along the main axis from the apse to the central dome and the principal buttresses rise to form striking features along the sides of the dome-base. The relationship of these tall buttresses to the arches which carry the dome is more clearly demonstrated in the familiar view of the southwest corner (FIGURE 3), while the elements of the original entrance facade are shown in a view from the west (FIGURE 4).

The multiplicity of forms evident on the exterior poorly prepares one for the great openness and remarkable simplicity of the interior, qualities seen to best advantage from the center of the west gallery, the place reserved in Byzantine times for the Empress and her retinue (FIGURE 5). This simplicity originates in Anthemius' and Isidorus' ingenious disposition of supports for the dome. The plan arrangements devised by them (FIGURE 6) remain basically unchanged, except for the disappearance of the former atrium at the west. The plan consists of two narthexes, the nave with an apse at the east, and the side aisles. The nave is essentially a rectangle, with its corners rounded by exedrae, which measures nearly 33 m. wide and, with the apse included, more than 75 m. long. The middle part of the nave, beneath the dome, is a square bounded by four main piers, the lateral pairs of which are joined by straight colonnades of four verde antique monoliths. The curved ends be-

neath the semidomes on the east and west are bounded by secondary piers which are joined to the main piers by colonnades composed of two shafts of red porphyry beneath still smaller semidomes. The aisles as well as the galleries above them are divided into vaulted bays by the buttresses which are connected by barrel vaults and arches to the backs of the main piers. These spaces of varied shapes are enclosed within a rectangle of thin walls.

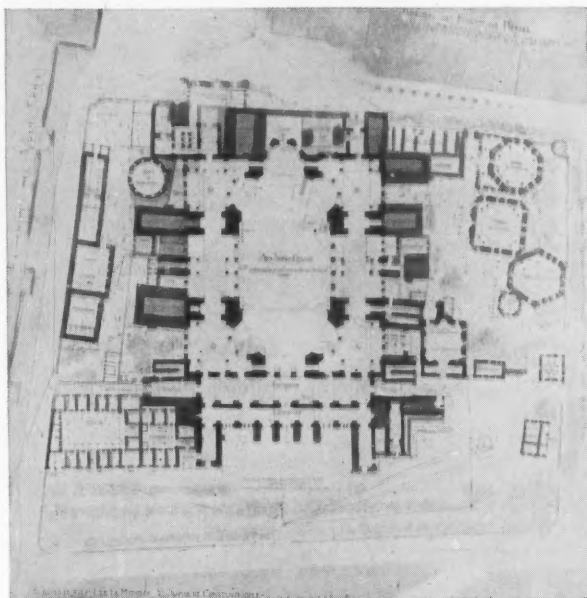


Fig. 6. Hagia Sophia. Plan, by Prost.

The longitudinal section of H. PROST (FIGURE 7), drawn with a view to representing the church as if Byzantine ceremonies were in progress, demonstrates how the succession of upward curves of the semidomes enhances the feeling of spaciousness created by the central dome, the crown of which stands 56 m. above the floor, the height of a modern building of fifteen stories. In the section, also, is clearly shown one of the departures from classical tradition in the placing of six columns in the central bays of the gallery over the four beneath, and six in the

curved parts over only two below.

The openness and lightness achieved by such innovations within the general scheme, combined with the rich color of the colonnades and revetments, and the brilliance of more than four acres of gold mosaic with which the vaults were originally covered, make this one of the handsomest spaces ever designed. As seen for the first time, it is literally breath-taking, and the vastness of its scale has even greater impact when seen from the seldom-visited cornice of the dome some 40 m. above the floor (FIGURE 8). In spite of injuries suffered by the decoration during the vicissitudes the building has endured, the impressiveness of the interior seldom fails to stir the most jaded modern tourist, and there is convincing testimony of its effect upon mediaeval travelers.

When in the ninth century, for example, Czar Vladi-



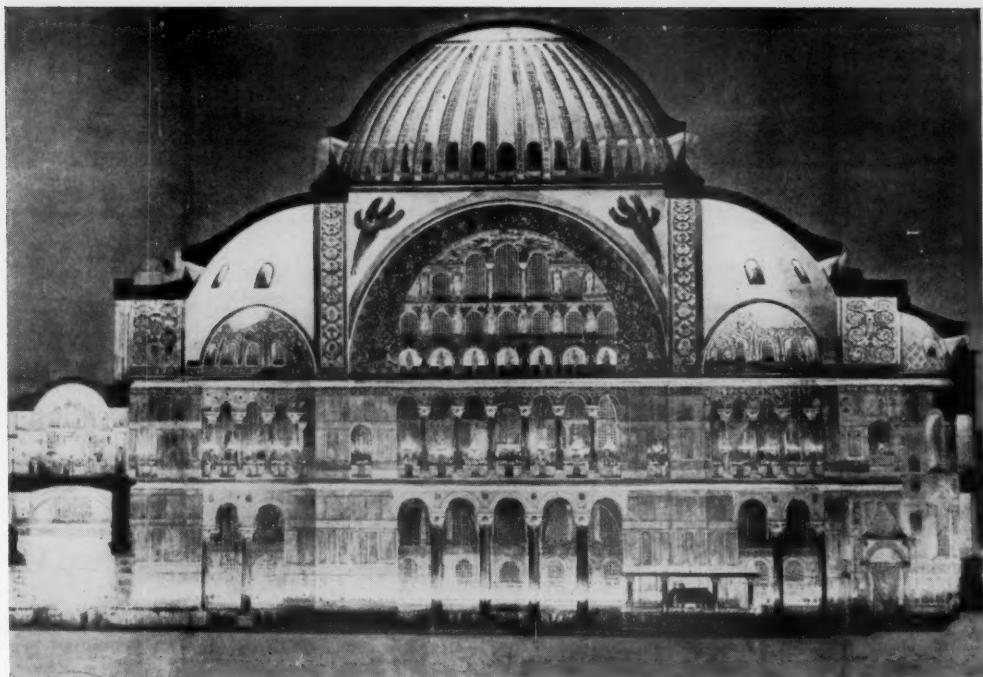


Fig. 7. Hagia Sophia. Longitudinal section, by Prost, showing the nave as if Byzantine ceremonies were in progress.

mir of Russia, then a pagan land, sent emissaries to neighboring countries in search of a state religion, the two who came to Constantinople were so overawed by Hagia Sophia that they reported, "Surely this is the House of God," and on the strength of their affirmation Vladimir accepted the Orthodox creed.

Moving as is the impression one gets today, it differs from the original conception of Anthemius and Isidorus because of the later replacement of their short-lived dome. Except for the fact that it was lower than the second, the form of the first dome cannot be established with any degree of certainty. But some of the causes which led to its collapse merit attention both for their general interest and for the evidence of them remaining in the present structure which materially affected the repairs of the fourteenth and tenth centuries and, particularly, the construction of the second dome.

**D**ESPITE A DIFFERENCE IN HEIGHT between the first and second domes, the problem of determining the causes of the collapse of the original one may be approached by reference to the existing cupola, first because the lateral thrusts of all simple domes act according to the same principle, and particularly because the

piers and buttresses we have today are those designed specifically for the support of the first dome.

The collapse has in general been attributed partly to the effects of the earthquakes and partly to the fact that the piers and buttresses were incapable, because of faults in their initial design, of holding in equilibrium the lateral thrusts generated by the dome. The earthquakes did, of course, harm the building, and some of the obvious sources of weakness inherent in the design and disposition of supports for the dome could be identified in the conventional drawings thus far available. The more detailed information now in hand indicates that there were two other contributing factors: flow in the mortar and subsidence in the substructure.

The articulation of Hagia Sophia's structure can be grasped in a spectacular isometric section by PROST (FIGURE 9) more easily than in the building itself. Here is made clear the manner in which the dome rises above a square formed by four equal arches which spring from the main piers and enclose the pendentives curving inward to create a circle. The transverse arches on the east and west are open beneath and backed by the semidomes which spring from the secondary piers; the lateral arches on the north and south are filled by

tympana, unsupported across their crowns, and reinforced at right angles to their springings by the buttresses which, though they may not originally have reached their present height, rise today to the level of the base of the dome. This ingenious arrangement of supports for the enclosure of such a vast space—one in which the piers, secondary piers, and buttresses occupy only six to eight per cent of the floor area—had, unfortunately, certain illogical features.

One obvious weakness resulted from the piercing of the main piers, at gallery level, by tunnel vaults. A further subtraction from the mass of the piers was made in order to lengthen the colonnades of the adjoining exedrae. As a consequence the cross-section area of the piers at this level is abruptly reduced by one third as compared with that at the ground floor.

But a more important fault was the employment among the four arches supporting the dome of two kinds of arches with different structural potentialities. Of the four arches of equal span visible on the interior only the open transverse arches

backed by semidomes are working arches. These are as thin at their crowns as they appear to be. The visible arches which project from the tympana on the sides of the nave are simply applied to the real lateral arches. The working arches on the sides of the nave span only the distance between the inner corners of the piers and are shorter than the others by nearly 6.0 m.; they are also thicker through their crowns and broader on soffit; and, being flush with the tympana, are visible from the interior only as discolorations in the surface of the window walls. A final flaw in the original design, as will become apparent in the following discussion of forces at work in the structure, was the placing of the but-

tresses illogically in relation to the thrusts they were intended to counter.

As the thrusts of simple domes are radial and equal in all directions and their intensity varies inversely with the rise of shell, the greater outward thrusts generated by the first dome were resolved, as in the present struc-

ture, on the diagonals through the centers of the pendentives. But no counter-support was provided in this direction, for the buttresses lie at right angles to the piers. Since the outward thrusts were not held in equilibrium at the base of the dome, one part of them was transmitted directly to the piers at an acute angle in plan, and by the piers to the buttresses through the relatively thin barrel vaults and arches connecting them. Another part of the outward thrust was transmitted through the semidomes to the secondary piers.

Though such a brief statement oversimplifies a very complex problem, it serves to emphasize an important characteristic of Hagia Sophia's structure, namely that the lateral thrusts of the main dome and its subsidiary

semidomes, plus their deadweight loads, are concentrated at only twelve points, the main and secondary piers and the buttresses. This means that the tympana, the colonnades below them, and all the vaults of the galleries and aisles, except at their actual joinings with the piers and buttresses, are independent of the primary system of support for the dome.

**T**HE MATERIALS EMPLOYED in the structure merit a brief digression before we attempt to estimate the forces at work in them. The piers are of stone and the arches, pendentives, buttresses, exterior walls, etc., are of brick, but the fine preservation of the building, which



Fig. 8. Hagia Sophia. Southwest exedra, from the cornice of the dome.

prevented earlier investigators from giving close attention to its materials, still makes it difficult to examine the actual fabric. One is consequently obliged to rely on evidence exposed by gaps in the marble revetments, or in the plaster with which lost slabs have been replaced. In such a gap at the back of the southeast pier, at gallery level (FIGURE 10), the thick courses of fossil-bearing limestone of the piers are clearly distinguishable from the thinner courses with which the former tunnel vault has been filled. A point of special interest is clarified by the discovery in this and similarly limited areas in other piers of a sheet of lead 9 mm. thick extending throughout the joint at the spring of the vault. The presence of lead here, as well as at a comparable height in the buttresses at ground level, confirms for the first time Procopius' hitherto unsubstantiated statement to the effect that lead was employed in the joints of the piers.

Almost the only sources of information regarding the brickwork are the small and often lightless turnings of the stairways enclosed within the four buttresses (FIGURE 11), which have heretofore been largely ignored. Because each buttress differs from the others in some significant manner, we were obliged to survey all four. If their original turnings were added together, they would equal a stairway thirty-four stories high. In the twenty-four turnings that can be explored today, eleven kinds of brickwork are clearly identifiable. Three of the types most frequently encountered come together at a landing in the southeast buttress (FIGURE 12): at the right, Turkish masonry of the sixteenth century, consisting of two courses of thin bricks alternating with one of rubble; at the left, late Byzantine work, possibly of the tenth century, with mortar joints pointed to a slanted, or "weathered," surface and the upper edge of the brick courses marked by a

sharp line; and, in the center, original sixth century work consisting of bricks averaging 0.045 m. thick and 0.375 m. square, laid up in mortar joints somewhat thicker than the bricks themselves and pointed to a slightly concave surface. Since all the original bearing walls in the building contain this last kind of brickwork, it is highly significant that some of the bricks in the great arches of the dome are nearly twice as large.

The interpretation of such data has been advanced in valuable and often unexpected ways through technical analyses by authorities in various fields at The Massachusetts Institute of Technology. For example, the report in a late Byzantine manuscript to the effect that the mortar was mixed with a broth of boiled barley and willow twigs led us to enlist the help of FREDERICK K. MORRIS, emeritus Professor of Geology. His examination of a thin section of the sixth century mortar, which contains lime, sand, some gravel, and chips of crushed brick, shows that if such vegetable substances were ever actually used, no traces of them can be identified at the present time. In the same sample of mortar he found a grain of a particular kind of granite which provided useful clues to the sources of materials employed in the initial construction. Because of the known history of this type of granite and the absence of granite of any kind in the region of Istanbul, this grain must have been eroded from exposures northward of the city, possibly as far away as the Dobrudja, and have been carried

by surface currents to beaches within reach of the builders of Hagia Sophia, such as those near the entrance to the Bosphorus on the coast of the Black Sea from which sand is brought to the modern city of Istanbul. This indication that sea sand was used in the mortar recalls Vitruvius' formula recommending, for mortar made with sea sand, the admixture of crushed brick. WALTER C. VOSS, Professor of Building Construc-

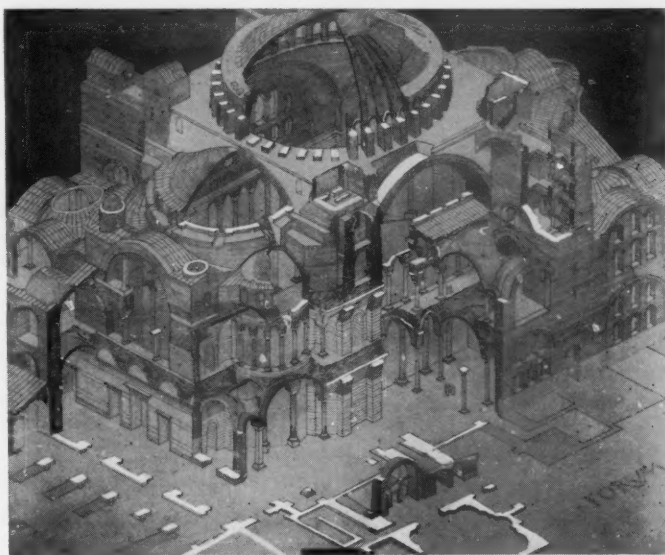


Fig. 9. Hagia Sophia. Isometric section, by Prost.

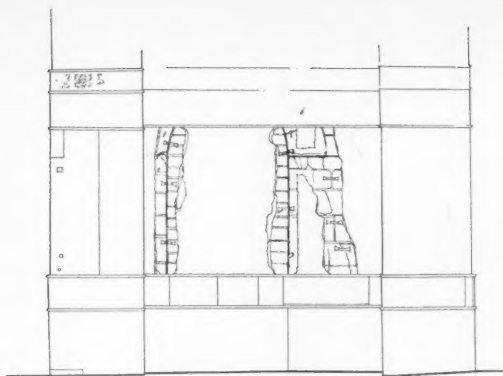


Fig. 10. Hagia Sophia. Rear elevation of south-east pier, at gallery, showing the former tunnel vault. A sheet of lead extends throughout the joint at the springing of the vault.

tion, points out that Vitruvius was right, but probably for the wrong reasons, for though salt has no adverse effect on the setting up of lime mortar, the presence of such a porous substance as crushed brick aided the absorption of excess water and thereby improved the density of the mortar.

Another valuable clue to the provenience of materials came from Professor MORRIS' study of a chip of crushed brick which happened to be in the sample of mortar. The mineralogical components of this chip from a brick obviously older than the building itself prove to be identical with those of whole bricks in the sixth century walls and of Turkish bricks in repairs of the sixteenth century. This indicates that all three bricks were manufactured from the beds of marine clays in which Istanbul is situated, for clays of marine origin are capable of producing homogeneous bricks over a wide area and for long periods of time. On the other hand, the minerals in bricks of the largest size, which are found chiefly in the great arches of the dome and measure as much as 0.70 m. square, are entirely foreign to those of the local clays. Since these extraordinary dimensions are related to

those of the Roman bipedales, which ceased to be manufactured long before the sixth century, the bricks must have been imported from Rome, or from Roman ruins elsewhere, specifically for the construction of Hagia Sophia's main arches.

THE CHARACTERISTIC OF the earliest masonry most significant from a structural point of view is that the mortar joints are thicker than the bricks themselves. The ratio of brick to mortar is consequently 1 to 1.4 in the original walls. As a number of years are required for mortar in deep masses to dry out and attain its ultimate strength, and in view of both the thickness of the walls and the rapidity of their initial construction, we may be certain that the masonry was charged prematurely with the full lateral thrusts of the dome. The flow in the uncured mortar, inevitable under the circumstances, caused the arches, buttresses and other elements to give within themselves.

The slow consolidation of the mortar within the structural members was accompanied, it is now clear, by subsidence underneath them. According to preliminary calculations by ERNEST N. GELOTTE, Professor of Construction, the bearing pressure exerted by the piers and buttresses reaches an average intensity of 105 tons per square meter. While this is safely within the

allowable limit for the limestone of the piers, it is sufficient to cause subsidence in the rock on which they stand.

The necessity of determining the foundation conditions brought us in touch with the colorful and persistent belief that vast cisterns are enclosed within Hagia Sophia's substructures. This legend, though not confirmed by the four earliest descriptions, is based upon the reports of mediaeval travelers, like that of Clavijo who passed through Constantinople, sometime between 1403 and 1406, on his embassy to Tamerlane.

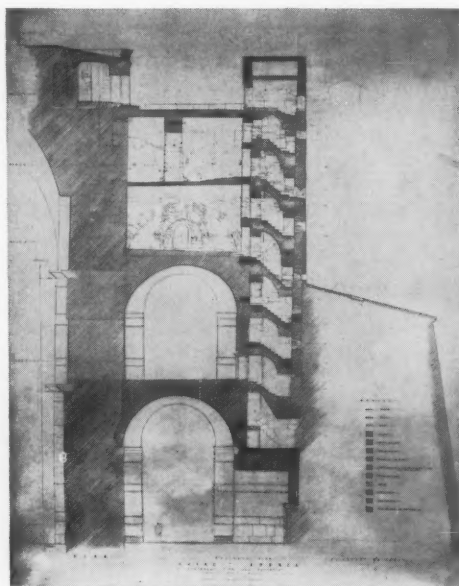


Fig. 11. Hagia Sophia. Section of the south-east buttress. (Preliminary drawing)



"There is underground in St. Sophia," he wrote, "an immense cistern holding much water, and it is said to be so large that a hundred galleys might easily float upon it." But the well often pointed out as the entrance to the supposed cisterns proves to be a shaft cut from natural rock. From the examination of this and other wells in the neighborhood, and the exploration of several passages extending for more than three hundred meters underneath the western part of the building, it appears that a bed of Devonian rock underlies much of it and extends in some places to within one meter of the floor. This rock is weak enough, in the opinion of KARL TERZAGHI, Professor of Soil Mechanics at Harvard University, to be compressed under the estimated bearing pressures exerted by the piers. This final bit of evidence puts us in position to assess the causes of the collapse of the dome.

Among the multiple forces which brought down the dome there was, first, the fact that its lateral thrusts were excessive for the supports on which it rested, and these disruptive forces soon searched out weak points such as the tunnel vaults through the piers. At the same time, the main supports of the dome were giving internally because of flow in the mortar, and the rock beneath the piers and buttresses was subsiding under their tremendous weight. But since the forces generated by the dome tended to tip the piers and buttresses backward, the pressure they exerted was not evenly distributed. It increased at the outer ends of the piers and buttresses, and the compression of the natural rock was there correspondingly greater. As the rock compressed unevenly, the piers and buttresses slowly tilted backward, and this movement was naturally associated with a gradual widening of the span of the dome arches. Then, while these formidable forces were already in action, there came not only the earthquake of 553, but a second one in December, 557.

What was the effect of these earthquakes? It is impossible to say specifically, though the principle involved can be explained on the basis of recent research. An earthquake is not likely to dislocate the foundations of buildings built, like Hagia Sophia, on bedrock. What happens is that the vibrations accompanying the quake are transmitted through the rock into the members of the structure; if these members are sufficiently large, they may vibrate in phase; the vibration in phase sets up kinetic energy which causes fractures in the fabric above ground. This is probably what happened to Hagia Sophia's eastern arch during the second earthquake.

As to the amount of injury suffered when the arch collapsed, the contemporary reports are as vague, unfortunately, as they are about the form of the dome. The extent of the damage can only be inferred from the mention of ceremonial furniture stated to have been destroyed. At any event the disruptive forces which



Fig. 12. Hagia Sophia. Landing in southeast buttress where three types of brickwork come together: in the wall at right, Turkish masonry with two courses of thin bricks alternating with one of rubble; in the wall at far left, middle Byzantine insertion with slanted mortar joints and the upper edge of each brick course marked by a sharp line; in the center of the wall at left, the original sixth century brickwork with joints concavely pointed.

threatened the building from the moment of its completion must soon have become apparent. Possibly the thin marble floor slabs of the gallery were split as their supporting vaults were being deformed, the slabs of the revetments may have become dislodged by shifts in the piers, and it seems highly probable that as the vaults and arches were strained there was an increasing fall of mosaic cubes from their surface decoration. In view of the factors contributing to the disaster, which have been explained above, as well as others of which we may not yet be aware, the continuing wonder is not so much that the dome came down as that for six months after the earthquake of December, 557, until May 7 of the following year, it remained standing.

## A SILVER THREE-OBOL PIECE FROM ATHENS

THE ANCIENT ATHENIAN COIN illustrated in FIGURES 1 and 2, where the coin is represented at ten times its real size, was given to the writer about twenty years ago by his brother-in-law, Mr. NICOLAS PEROGLOU of Athens. The coin had been found some years earlier, on Mr. PEROGLOU's estate on the island of Aegina, when the ground about his pistachio trees, of which he had about eight hundred, was being turned over, a process in which the earth is not disturbed to a depth of more than about 15 cm. No record was kept of the exact tree beneath which the coin lay buried. To this uncertainty we may add that otherwise only a few sherds of ancient vases and lamps have been dug up on Mr. PEROGLOU's property. We may imagine, therefore, that the coin found its way to Aegina in antiquity and was then lost accidentally; or that the same happened to it in any succeeding age. Thus little importance can be assigned to the fact that the coin was found on Mr. PEROGLOU's property.

The coin is an Athenian silver triobol. On one side, the obverse, is the helmeted head of Athena; on the other side, the reverse, instead of the usual owl, is the unhelmeted head of Athena Ergane, Athena in her rôle as patron of the arts and crafts, with the letters ΑΘΕ (left) and the spray of olive leaves (right). Both heads are looking to the right. The average diameter of the coin is 1.2 cm. Its weight is 2.06 grams. When it was struck, an upper and a lower die were used, as in the minting of coins of today. In antiquity the pressure between the two dies was obtained by the blow of a sledge hammer; today the dies are pressed together by machinery. The relation of the obverse to the reverse is similar to that, for example, of American coins of today—that is, if we start with one of the heads upright, and then revolve the coin while holding it at the sides, the other head will come upright.

J. N. SVORONOS publishes our coin in his remarkable book *Les monnaies d'Athènes*. He illustrates five examples of it (Plate 7, Nos. 30, 31, 32, 33, 34). They are now in Brussels, Paris, the Philipsen Collection, London, and Vienna. The writer's coin is, however, better preserved than any of these five. SVORONOS died in 1920 (his book



was published six years after his death). So far as the writer of the present article can ascertain, no other examples of our coin have been found since the death of SVORONOS. The National Numismatic Museum in Athens has no coin of this type. The writer is, therefore, bequeathing the coin to the museum.

SVORONOS is undoubtedly correct in assigning the coin to a date not far from the end of the sixth century B.C.—certainly to a date not later than the battle of Marathon (490 B.C.). The coin was probably struck in the time of Cleisthenes (506-490), when the Athenians were doing their best to forget the Pisistratids and all their ways—a

freed Athens was rapidly developing in every field of activity, including that of art. Little wonder, then, that the artistic quality of our coin shows a marked change over that of the time of the Tyrants (cf. SVORONOS, Plates 4, 5, 6, 7).

The care with which the dies of our small coin must have been cut should be noticed. Obviously either especially skilled die cutters were needed for small coins, or the die cutters assigned to small dies took greater care than if the same cutters were working on big dies. In other words, if

The way the die cutter of our coin indicated eyes (archaic in their frontal view), noses, mouths, chins, ears, hair, etc., can be easily studied in the two enlarged photographs. Note the extraordinary difference in the rendering of the two eyes. And there is almost as marked a difference in the modeling of the cheeks. Here are indications that the two dies were cut by different artists. The cutter was no amateur—indeed no amateur would have been commissioned for important dies in the art-loving Athens of Clisthenes' time. A study of many photographic enlargements of Athenian

coins, if for the moment we confine our attention to the coins of Athens, would undoubtedly reveal the individual characteristics of the various Athenian die cutters. Probably the die cutters could be classified in accordance with the characteristics displayed in their coins. Perhaps even the early, middle, and late works of some of the die cutters could be distinguished.

And let us remember that the very fact that coins can be fairly accurately dated would be a great asset in such a study. The development from age to age of the art of the Athenian die cutters, just as in the case of Athenian sculptors and architects, would surely be found to reflect the political, economic and artistic life of Athens. For example, both C. T. SELTMAN (*Masterpieces of Greek Coinage*) and G. H. HILL (*Select Greek Coins*) publish a number of enlargements. But, when we consider the vast number of

we had a series of photographs of big and small coins, and if the photographs magnified the coins, let us say, ten times, the photographs would demonstrate the general rule, with some striking exceptions, that the smaller the coin the better the workmanship.

coins which have been published only at natural size, it seems obvious that with enlarged photographs further valuable work could be done.

—GORHAM P. STEVENS  
*American School of Classical Studies at Athens*





Iznik. The Lefke Gate was built during the reign of Hadrian, a result of that emperor's policy of provincial consolidation.

# IZNIK

By Cyril A. Mango

ON THE BANKS OF A STAGNANT LAKE IN THE north-west corner of Asia Minor stands the little town of Iznik where malaria flourishes. This is the ancient Nicaea, and the lake is the "inexorable Ascanius" whose nymphs ravished the beautiful Hylas, the boy-friend of Hercules, who in a bout of grief nearly gave up the Argonautic expedition. Nicaea, we are told, was founded in the late fourth century B. C. In 57 B. C. it was visited by the poet Catullus who found the climate unbearable and was glad to get back home. Pliny the Younger passed

the winter of 111 A. D. there in the grand capacity of provincial governor. The historian Dio Cassius was a

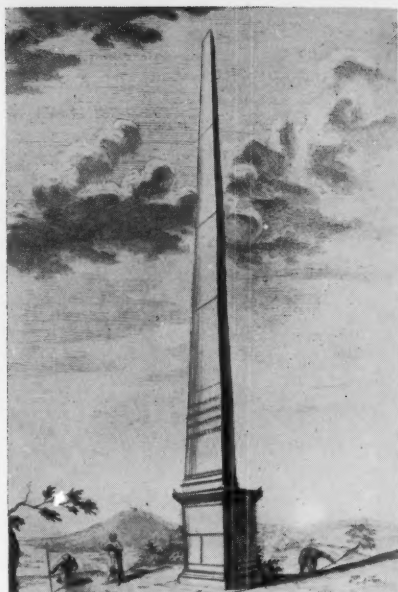
native of Nicaea, and after a successful career in the Roman civil service he went back there to die. The layout of the city goes back to that period; the regular circuit of the walls with its stately gates built like triumphal arches, and the two straight arteries intersecting in the middle belong to the tradition of the Roman camp.

With Constantine we start on a new period. In 325 A. D. Nicaea was the scene of the first Oecumeni-



Iznik. One of the Roman gargoyles from the Istanbul Gate, which goes back to the time of Hadrian.





Just outside Iznik stands the triangular obelisk of C. Cassius Philiscus, who, as the inscription says, died at the age of 83. The plate is from Richard Pococke's "Description of the East," London 1743.

cal Council of the Christian church, presided over by the Emperor himself. It resulted in the condemnation of the Arian heresy, and the formulation of the Nicene Creed. The fathers, we are told, met in a palace by the side of the lake. No trace of it remains now, nor is one tempted to take the word of OGIER GHISELIN DE BUSBECQ, the German Emperor's ambassador at the Porte, who says that he slept in that very building in 1555.

The chief gem of Nicaea used to be the church of the Dormition of the Holy Virgin, which was unhappily destroyed thirty years ago. It

The Yenisehir Gate shown here was put up by Claudius II Gothicus, who also restored the entire line of the city walls after the devastation wrought by the Scythians in 259 A.D.

possessed some remarkable mosaics—in the apse a full-length Virgin in an ample blue cloak holding the infant Christ; on the arch above the mystical "preparation of the throne" which symbolized the Second Coming; in the narthex another Virgin with arms upraised, dressed in a violet cloak with gold highlights. Most of these mosaics probably went back to the ninth century, though their date is still disputed.

The later history of Nicaea is an endless succession of sieges and battles. In 1081 it was taken by the Seldjuk Turks. The Crusaders suffered a severe defeat before its walls, but the place was recaptured by Godfrey de Bouillon in 1097 after the Byzantine fleet had been hauled across from the sea and launched in the lake.

When in 1204 Constantinople fell to the soldiers of the Fourth Crusade, Nicaea became for half a century the capital of the Greek empire. The court of the Lascarids, though constantly shaken by intrigue, gained brilliance from the presence of refugee scholars. In 1330 Nicaea was conquered for good by the Turkish Sultan Orhan, who



Placed over a Byzantine parapet is a fine fragment of a "Sidamara" sarcophagus (about third century A.D.). This striking style of sculpture originated in Asia Minor, and is marked by an alinement of figures in a series of niches, and the replacement of the chisel by the drill, thus giving a strong contrast between light and shade.



made it for a time his capital. In 1402 it was sacked by Tamerlane's troops.

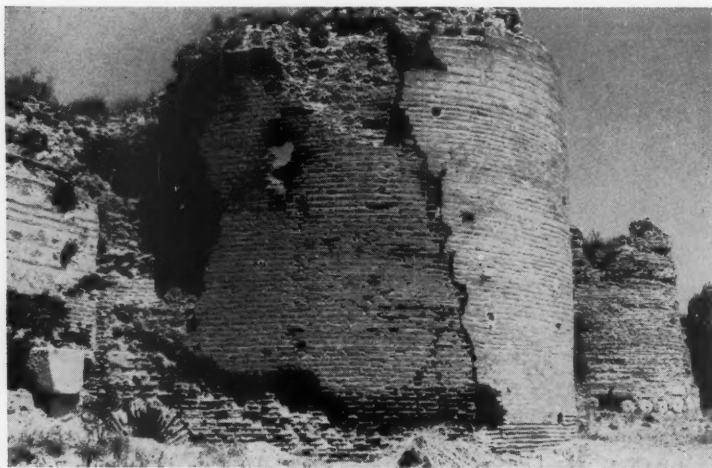
Perhaps pottery was manufactured in Nicaea even in Byzantine times. But it was under the Turks that it achieved its remarkable fame, the highest peak being in the middle of the sixteenth century. By the seventeenth the town was already on the decline, but the population still numbered some 10,000. Soon it had shrunk to a little village of mud houses within the immense circuit of the ancient walls, so that in 1799 the Rev. W. CARLYLE could sit amidst the overturned stones, overcome by the evanescence of past grandeur, and vent his emotions in indifferent verse:

Those scenes are fled—those domes are  
swept away—  
Succeeding domes now totter to their  
fall,  
And mouldering mosques on mouldering  
fanies decay  
While desolation bends to grasp them  
all.



The apse of the church of St. Sophia, a fifth century basilica now in ruins. It still keeps some frescoes of a later date, much blackened by smoke and disfigured. Here in 787 A.D. was held the seventh Oecumenical Council which concerned itself with the niceties of image worship.

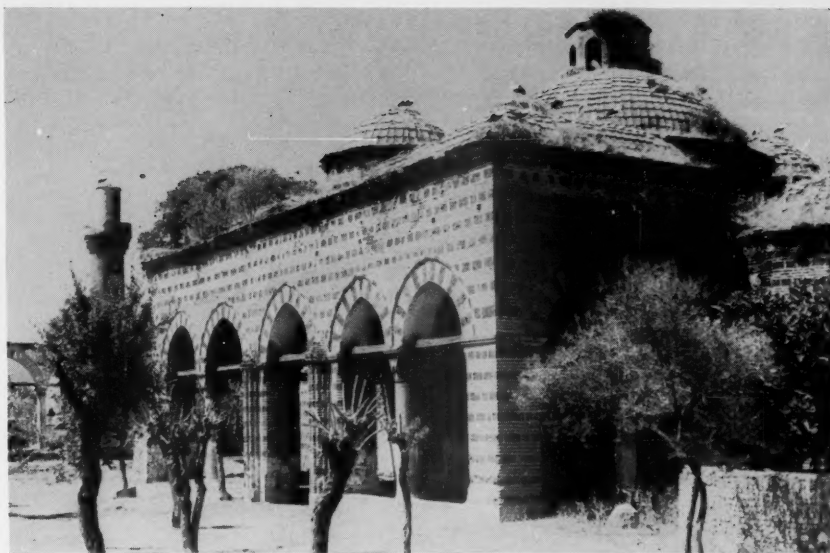
A superb specimen of the "windblown acanthus" capital, fifth century A.D. Less fine examples exist at Ravenna and Venice, where they excited Ruskin's enthusiasm. The small "impost" capital placed over it is of the sixth century.



The Isnik of to-day is a small village surrounded by groves of mulberry trees, the cultivation of the silk worm being the main source of livelihood. The bug-ridden "Republic Hotel" welcomes the occasional antiquarian.

The city walls, still largely intact, are a patchwork of successive repairs. Stretches of massive Roman stone alternate with neat Byzantine brick, or the more irregular Turkish work with tiles arranged in herringbone patterns. The tower shown here was rebuilt after the great earthquake of 1066 A.D.

Iznik. An imaret (kitchen for the poor) built in 1389 by Nîlûfer Hatîn, wife of Orhan. The Sultan was noted for his charity and was often seen serving soup to the poor with his own hands.



(Below) Minaret of the "Green Mosque" (1384-1389), which is entirely covered over with glazed tiles brilliantly coloured. Though rather heavy in appearance, and not so well known as the Green mosque of Bursa, it is nevertheless regarded as one of the masterpieces of early Ottoman architecture.



(Above) Iznik is the supposed home of a remarkable pottery industry which reached its height in the sixteenth century. The beautiful stylized tiles which cover the interiors of the mosques and palaces of Istanbul were produced here, as well as vases and plates like the one pictured here. The dominant colors are blue, turquoise, and tomato red. The design, though formal, is never mechanical, and a certain depth was secured by a slight running of the paint into the white background. (*Louvre Museum*)

# A PRE-COLUMBIAN COLONIZATION OF THE AMAZON

By Betty J. Meggers

Betty J. Meggers, a native of Washington, D.C., took her B.A. at the University of Pennsylvania (1943) and her M.A. at the University of Michigan (1944), and is working toward the Ph.D. degree in anthropology at Columbia University. She is at present lecturer in anthropology at American University, Washington, D.C. The Lower Amazon Expedition was organized by Miss Meggers and her husband, Clifford Evans, Jr., under the auspices of the Department of Anthropology of Columbia University, the Museu Nacional, Rio de Janeiro, the Museu Goeldi, Belem, and the Museu Territorial, Macapá, with financial assistance from the Viking Fund and a Columbia University William Bayard Cutting Traveling Fellowship. The expedition was in the field from July 1, 1948, to July 15, 1949. One phase of their activities is described in the article which follows; another, by Dr. Evans, will appear in the Autumn number of *ARCHAEOLOGY*.

IN THE LATTER DECADES OF THE NINETEENTH CENTURY NATURALISTS began to peer into the vast, jungle-choked Amazon lowlands, lured by the probability of discovering new plant and animal forms, unrecorded rivers, and geological formations, or drawn by the irresistible magnetism of exploration. As they traveled, using means of transportation and enduring discomforts and delays that still plague travellers today, they took note of everything—Indian customs, fishes, insects, birds, languages, plants, geographical features, and archaeological remains. It is in this period that one finds the first accounts of large mounds and elaborate pottery on the island of Marajó, in the mouth of the Amazon. The collections brought back found their way into museums in Europe and America, and the high level of technical and artistic achievement they demonstrate has provoked speculation as to the origin and identity of the makers ever since.

It was in the effort to shed some light on this question that we went to Marajó in the spring of 1949. Because of the limited time at our disposal and the uncertainties of transportation, we decided to make a concentrated study of two groups of mounds in the headwaters of the Rio Anajás, almost in the center of the island (see map).



MAP OF THE AMAZON RIVER MOUTH AND ADJACENT AREAS. THE TRIANGLES MARK THE LOCATIONS OF ARCHAEOLOGICAL SITES. THE CIRCLE ON MARAJÓ ENCLOSES THE AREA IN WHICH THE MAJORITY OF THE ARTIFICIAL MOUNDS ARE FOUND.



Fig. 1. Marajoara habitation site, Brazil.

This is a small habitation mound on the Igarapé Camutins, at highest water level. Potsherds are numerous in the eroded bank.





Fig. 2. Marajó Island, Brazil. A large habitation mound.

Another habitation mound on the Igarapé Camutins, this one especially large. A modern cowboy has taken advantage of its dry summit for his thatched house.

most to a standstill at this part of the year and the inhabitants spend much of their time in the shelter of their "lake-dwellings": pile houses, out of sight of water in the dry season, but now accessible by dugout canoe.

When we paddled and poled our way over to take a look at some of the mounds, we readily perceived why the ranchers are loath to grant permission to archaeologists to excavate in them. Although the water level had risen some ten feet in the stream flowing past their bases, the summits were sufficiently higher so that after each shower the water drained quickly off and left the surface compact and firm, if not dry. As we continued our examinations of the mounds along the Camutins, a tributary of the upper Anajás, we became impressed with a fact that has received little recognition in the literature. The great majority of the mounds do not produce the abundance of elaborate and varied ceramics for which the island is famous, but rather broken bits of unornamented bowls and jars thinly scattered in the dirt: typical refuse from a village site. The elaborate wares come almost exclusively from mounds constructed for burial of the dead, although here too there is a high percentage of unpainted and unincised pottery.

Two of the habitation mounds along the Camutins are shown in FIGURES 1 and 2. The first mound is 10 meters wide by 18 meters long, with an almost level summit about 1.5 meters above the high water level. Like all the mounds, it is now covered with trees and grass, but below the surface and protruding from the eroded banks are occasional plainware sherds. Less typical of the habitation mounds is the one shown in FIGURE 2, 250 meters long and reaching over 6 meters in height. It is the only habitation mound of this size in the area, and the fact that it lies opposite the burial mound and contains a larger amount of decorated ware than usually found in village refuse makes it probable that it was of special ceremonial significance. We mapped and made sample

collections from all nineteen of the village mounds in the group and sank stratigraphic tests into two of them in order to determine the construction. Analysis and interpretation of these data permit some interesting conclusions on the pattern of village life of these expert potters.

The mounds were built up of soil taken basketful by basketful from the surrounding area and piled on a spot along the river bank. Some were built up only



Fig. 3. Marajoara domestic pottery.

These are typical plainware vessels from the habitation mounds. The object in the lower right is a low stool. All scales are in centimeters.

high enough to escape flooding, while others reached as much as 4-5 meters before construction ceased. On top of this sterile soil is the occupation layer, varying



Fig. 4. Typical Marajoara burial mound.

Guajará, a burial mound on the upper Rio Anajás, is now completely overgrown with large trees.

from a few centimeters to 2 meters in thickness and reflecting considerable differences in the length of time during which the various mounds were in use. Analysis of the soil conditions in the refuse layer points to the probability that the inhabitants departed from the usual pattern in the area by constructing their houses directly on the ground, with dirt floors, instead of raising them on piles. Such a situation makes it easier to understand why these Indians devoted such an enormous amount of labor to mound-building.

These houses probably had few furnishings and those were of a perishable nature, except for low stools of pottery like the one in FIGURE 3 (lower right), which was found in one of the habitation mounds. The other vessels in FIGURE 3 are typical of the utilitarian wares made for cooking, carrying water, and storing food. In keeping with their function, they have interiors that are well-smoothed and exteriors that are undecorated and often rough.

**A**FTER ESTABLISHING THESE facts, we turned our attention to the burial mounds. One was part of the large village complex just described, and two others were along the main stream of the Anajás, about three hours row-

ing across the inundated land to the east. A description of our excavations in one of the latter, called Guajará (FIGURE 4), will afford more justification for the enthusiasm of those who have become acquainted with Marajoara remains.

The cemetery mounds average considerably larger than those constructed as dwelling sites, and Guajará measured 121 meters long, 55 meters wide and 4 to 6.5 meters high at the height of the wet season. The surface was strewn with broken pottery of all kinds and colors: curiously-modeled rims, pieces with crudely-scraped or boldly-painted designs, bits with delicate red patterns traced on a pure white surface, intricate incised motifs that filled one with regret that the remainder of the vessel should have been irretrievably lost (FIGURE 5). Now

and then a little figurine, or the realistically-modeled head of a jaguar, delights the searcher's eye, adding evidence of the potter's skill. So abundant are the sherds covering the ground that more than one visitor has compared their appearance to that of a great mosaic.

Much of the speculation about Marajoara origins and the history of its occupation of the island could be settled only by a stratigraphic test into such a burial mound, so once a spot was found that was relatively free from roots and fruit-tree cultivation, we set to work. The excavation



Fig. 5. Marajoara ceremonial wares.

These are specimens of some of the varieties of incised decoration, abundant in the burial mounds. The complexity of the decoration on the lowest one is evidence of a division of labor that permitted certain individuals to devote a major portion of their time to production of ceramics like these.

was 2 meters square and to be taken down until sterile soil indicated that the original building level had been reached. In the humus and for some distance below, the vessels were badly broken and the fill contained an abundance of sherds of all descriptions.

However, once this upper level, exposed to damage by trampling cattle and seasonal alternation between wet and dry, was removed, we were able to observe in remarkably good condition the burial practices of this people. The sherd-filled dirt gave way to a succession of increasingly large and well-preserved jars, so closely packed that one often rested directly above the other and there was barely room in the pit for an archaeologist to work between them. Resting 85 cm. below the surface was a small jar with red-painted designs on the exterior surface. The bowl once inverted over the mouth as a lid was broken, but two bowls, set one on top of the other and probably once containing offerings of food to the deceased, were still resting on the shoulder. Close by was a much larger, undecorated jar that we knew to be older because its base was 1.40 meters down. On the opposite side of the cut, at a depth of 1.08 meters, was the little jar shown in FIGURE 6 (right), with black curvilinear ornament and with the lid that fitted inside the flaring rim still in place.

The jars visible at a depth of 1.80 meters can be seen in FIGURE 7. The one on the left, although unprepossessing when covered with mud, was discovered to have its painted surface in almost perfect condition when it was taken down to the water's edge and washed (FIGURES 8 and 9). The solemn faces with bulbous eyes, bifurcated nose and protruding mouth, one on either side of the neck, are typical of these immense burial urns. Also characteristic are the little figures occupying the space between the ears and the over-all painted design in red and black combining stylized anatomical features with intricate geometrical patterns. In contrast to the lavishness of ornamentation on the jar, the lid was plain and similar to the basin in FIGURE 3 in shape. The only jar below this one was that visible at the right in FIGURE 7. Equally large, but plain, it rested at a depth of 2.25 meters.

Below the first meter of depth, the jars were 70 cm. or more in height, gracefully proportioned, well-fired and, when painted at all, painted with skill and artistry

(e.g., FIGURE 9). Inside were fragmentary bones from secondary burials and occasionally small bowls and a tanga (triangular ceramic pubic covering). From the depth of one meter up to the surface, the jars were typically small, squat, and decorated in a style that is only a crude reflection of the earlier excellence (FIGURE 6, left). They contained no tangas and the burial practice had changed to cremation. In a word, there is from bottom to top, or early to late, a marked degeneration in the ceramics, both in quality of manufacture and in decoration.

This situation, which is paralleled in the habitation sites, assessed in the light of several theoretical considerations, makes it possible to explain the existence of this culture on Marajó more clearly than has hitherto



Fig. 6. Marajoara burial jars.

These are two small burial jars from the stratigraphic excavation of Guajará. The one on the left is from the upper part of the mound and contained a cremation, while the one on the right contained a secondary burial.

been possible. The fact that it makes its appearance at the peak of its development indicates that this peak was reached elsewhere. Forced to abandon their homeland, the people traveled in search of a new spot in which to settle until they finally arrived on Marajó. Here they tried to maintain their old ways. Their social organization was well enough developed to permit the organization of the labor forces necessary to build the large and numerous mounds; their skilled artisans continued to devote their full time to the manufacture of high-quality ceramics, while the hunters and fishermen kept the community supplied with food.

But this kind of life could not continue to be supported by the resources of Marajó. The game became scarcer and more wary, the fish dispersed over the campo during the rainy season and were difficult to catch, the fruits were seasonal and required time and effort for their collection, and agriculture fares poorly



Fig. 7. Guajará Island, Brazil. Urn burials in situ

Looking into the Guajará excavation at the 1.80 meter level. The intermittent showers and wetness of the soil made it impossible to clean the vessels in situ for a photograph, but it can be readily seen that one of the jars is buried deeper than the other, indicating that it contained a burial slightly earlier in date.

when the land is alternately parched and sodden. Increasingly, people who had formerly been specialized artisans had to join in the food quest. As a result, their products declined. What we can see manifested in the ceramics is a clue to what must have occurred in all other phases of the culture, until it finally disappeared when the people were driven away or were conquered and absorbed by the next invaders of the island.

These invaders were Indians of the tropical forest pattern, who lived in small villages, moving often to conform to the food supply, making pottery that was useful but not elaborate, Indians who lived in a way not essentially different from that of the tribes in the Amazon basin today. The Marajoara, with their much more highly developed social and religious organization and their settled village pattern geared to an advanced agricultural economy, came to the end that so many more recent attempts at colonization have met. It flourished at first, but was unable to endure in the face of the meager subsistence resources of the jungle.

(See additionally on this topic a book review on pages 126-127 of this issue—Ed.)



Fig. 8. Cleaning a newly excavated jar.

When the burial jars shown in Fig. 7 had been removed they were carried to the swollen stream that ran along the edge of the mound and there washed.



Fig. 9. Marajoara burial jar ready for exhibition.

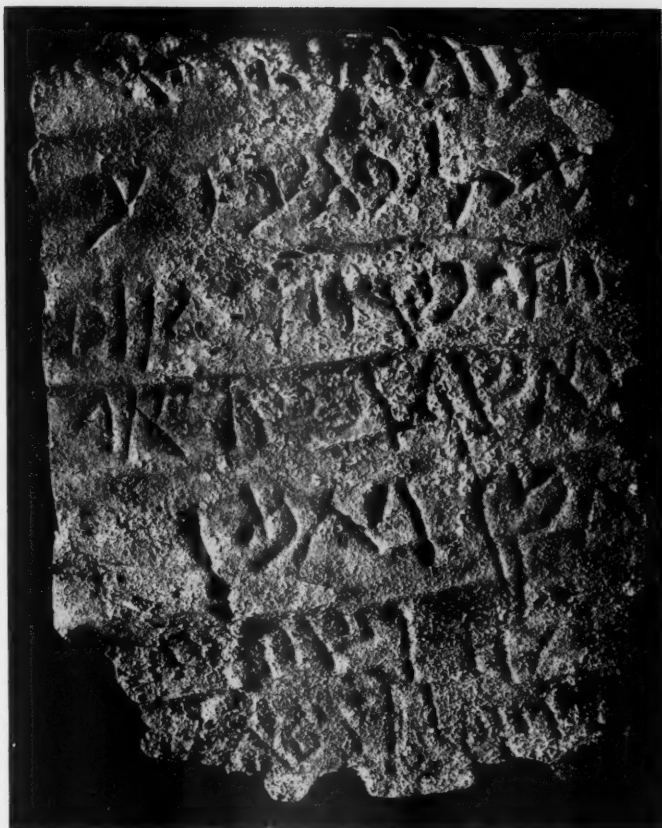
Two views of the jar shown in Figs. 7 and 8, a fine example of the excellence attained in painted decoration. The design is black on the body, and red on the neck, executed on a white slip. This vessel is 80 cm. high and 70 cm. in maximum body diameter. It contained the secondary burial of one individual.



# WHAT IS IT?

THE archaeological object pictured here (photographs by REUBEN GOLDBERG of the University of Pennsylvania Museum) is one of the most spurned objects from antiquity. It was found twenty years ago in the joint excavations of the University Museum and the Associazione Internazionale per gli Studi Meditteranei at Minturnae, Italy. It has not been reproduced until now. It is a part of a small lamina, or thin sheet, of bronze, and when found it was rolled up into a tight cylinder. When the discoverers saw that it was written upon, they gently unrolled it. It is incomplete. One side shows a fairly clean edge and may be the original side; on the other three sides it is broken. It contains seven incomplete lines of letters, with nine or ten letters to a line.

No one has been able to read them. No one has even positively identified the script. Photographs of it have been shown to twenty or thirty experts in ancient languages. The Latinists, with one exception, stated that since it contains Semitic (Aramaic, Hebrew) characters any competent Semitist should be able to read it off at once. The one exception said it was Greek. The Semitists unanimously rejected the idea that any of the characters were Semitic; most thought it was Latin, but three or four had no trouble



finding Greek letters on it, and two or three sensibly suggested a prowl among the little known scripts of the even less known Italic dialects. This was tried and turned out to be futile too.

Greek scholars, to a man, have disowned it.

Little laminae from Italy, like this one, when intelligible, usually turn out to have been inscribed for one special purpose only, to invoke a curse upon some associate or neighbor. The formulary of *defixiones* (curses) is well known, and if the script were Latin the recognition of a few letters should be enough to break the entire cipher; but not even this promising suggestion has produced any results.

We therefore, with the approval of the University Museum, throw it open to all comers. If you can read it or make out any words or merely identify the script, we shall gladly report your discovery. In the larger picture above we show what we *think* was the obverse, the side written on; but quite literally we do not know which side is up. In the smaller picture we show the other side, the reverse—or is it the obverse?—on which some letters undoubtedly are clearer, and possibly upside down too. Remember that these photographs are enlarged; the original is much smaller, 48 x 38 millimeters.

If you make head or tail of it, write the editor of *ARCHAEOLOGY*.

## University Museum Excavations in Iran, 1949

The University of Pennsylvania Museum, Philadelphia, has released a summary of the results of the 1949 explorations in Iran by CARLETON S. COON, curator of general ethnology. Highlights follow. Prehistorians will be interested to relate them to the mesolithic discoveries in Yorkshire described by GRAHAME CLARK in this issue, pages 66-70.

The expedition worked at various cave sites in Iran between June and November, 1949, but the most intensive excavation was carried out at a cave known as the Belt Cave, on a hillside four miles from the Caspian Sea, near the village of Behshar, where were found thousands of animal bones, human remains, and artifacts, including sickle blades for cutting grain, dating from 6000 B. C. or earlier, which would make this culture the earliest food-producing economy yet described.

Over 31,000 separate pieces and objects were unearthed in the cave. After initial sorting, examination, and classification at the site, a large part of these were sent to the University Museum. They included animal bones of both mature and young goats, sheep, pigs, cows, gazelles, oxen, seals, and dogs; bones of Neanderthal man; and hundreds upon hundreds of artifacts, including blades, saws, knives, scrapers, needles, sickles, chisels, fleshers, and other man-made implements, chipped from flint cores or carved from antlers and horns; milling stones and mortars made from sandstone; and jewelry fashioned from sea shells, perforated animals' teeth, jade, and polished stone.

The area in which the Belt Cave is located, near the southern coast of the Caspian Sea, had an ideal temperate climate for agriculture in the neolithic period. Protected by a mountain range, it never freezes in that area and there is adequate rainfall to sustain a rich soil. Garden and orchard fruits grow wild and the year-around moderate temperatures make the region especially well suited for cultivation.

The mouth of the Belt Cave is about 100 yards south of the highway from Firuz Kuh Pass to Gorgan and about 120 feet above the Caspian Sea. The cave is about 20 feet deep, with a level floor. Only a portion of it was excavated in 1949.

In excavating the cave a total of 28 layers or levels, each of 20 centimeters in depth, were successively un-

earthed. Accurate quantitative and qualitative data were kept on all objects recovered from every level. These served to show the comparative age and preponderance of similar kinds and types of objects found in each level, and indicate human occupation of the cave from the lower and upper mesolithic through the neolithic periods.

In the analysis and study of the animal bones it was found that those from the lower, more ancient layers were preponderantly the remains of full-grown, mature animals, indicating that in this early period, during mesolithic times, wild animals were hunted for their meat and skins, and thus most of those killed were the older and heavier ones. In later levels, the ratio of the large bones of mature animals to the small bones of young animals was reversed, so that the great majority were the remains of immature animals.

These facts suggest to Dr. COON first, that the herding of animals for their meat preceded either herding or domestication for milk and wool. Secondly, along with evidence from artifacts from the same levels, they show that, as the inhabitants began to cultivate the soil and grow grain, the older animals were domesticated and kept for their secondary products, chiefly milk from goats and sheep, sheep's wool, and goats' hair, while many of the younger ones were slaughtered. From the thousands of animal bones dug up it appears, according to Dr. COON, that the goat was the earliest animal to be domesticated, followed closely by the sheep, and that the pig and ox came later.

In a lower level of the mesolithic period the skull of a twelve-year-old girl of Neanderthal type, as well as remains of two adults, were unearthed. These were turned over to Dr. J. LAWRENCE ANGEL, of the Jefferson Medical School, Philadelphia, for study. In reconstructing the skull its bone structure was found to be transitional between Neanderthal man and more modern stages of man's development. Its age has been estimated at 8,000 to 10,000 B. C. This is the first evidence that men resembling the Neanderthal population of other parts of the world inhabited Iran long after the end of the last glacier in post-Pleistocene times. The bones of the two adults have not yet been reconstructed.

Over seventeen thousand pieces of flint, including

581 flint implements, were removed from the Belt Cave. During the lower mesolithic period this cave was definitely a flint factory. Three kinds of blades were found: coarse blades, usually short, broad and thick, from the mesolithic; slender, irregular blades, suitable for use as knives, from the neolithic; and fine, flat, parallel-edged blades, also neolithic, which marked the perfection of the flint maker's art and which passed over into the metal age throughout the Middle East, both in flint and obsidian.

All sickle blades found are of the fine-edged type. They are recognized as sickles by the patina on their cutting edges, derived from the silica in the grain stems which they were used to cut.

The neolithic cultural period is clearly distinguishable from the earlier mesolithic horizons by its preponderance of wood- and skin-working tools, its emphasis on knives, the appearance of pottery, and its possession of sickle blades. Saws, scrapers, and drills were found in all three periods, reflecting a constant need for these implements for which no other type of tool was suitable.

Many pieces of extremely primitive baked pottery were found in the neolithic levels of the Belt Cave. From an analysis, made by Dr. FREDERICK MATSON, professor of ceramics at Pennsylvania State College, of these crude potsherds, it appears possible that when they were fired they were tempered with chaff, additional evidence of the growing and culture of grain.

In addition to baked pottery, objects of many other neolithic types were recovered from the Belt Cave. These included chisels made from antlers, and among the bone artifacts, needles, awls, fleshers, and spokeshaves, the latter probably used for currying animals. Several polished stone ornaments, two of which are perforated, and stone celts of jade, were also found. The polishing on all surfaces of the stones shows a regard for the material usually found at the height of a cultural period. Five lumps of ochre, suitable for painting, came from various levels representing all periods. From the middle levels two mortars, still bearing traces of ochre, were unearthed.

As a result of the discoveries in the Belt Cave and the subsequent careful study and analysis by over a dozen scientists and scholars, Dr. COON arrives at the following conclusions:

(1) During late mesolithic times the inhabitants of

Belt Cave, located in the temperate climate of the south Caspian shore, were hunters. Their principal prey were gazelle and wild ox, but they also hunted wild sheep and wild goat. During this period they began to domesticate the goat, purely as a meat and skin producing animal.

(2) In early neolithic times the people who lived in this cave herded and raised both goats and sheep as animals for slaughter. They had not yet adopted cereal culture, pottery making, weaving, or the use of stone axes.

(3) In the later neolithic period the inhabitants of the cave adopted agriculture, pottery making, weaving, and the use of stone axes. During this period they began milking their sheep and goats and shearing their sheep. At about this time, or perhaps a little later, they also domesticated the pig and the ox. This agriculture and the domestication of animals existed at about 6000 B. C., a date derived by Dr. WILLARD F. LIBBY, University of Chicago nuclear physicist, from measurement of the radioactive carbon 14 (henceforth to be called "radiocarbon") content of this period recovered from the cave.

From the evidence he has discovered in Iran, Dr. COON believes he has traced the transition of these early people over a long span of time from a hunting and food-gathering culture, during mesolithic times, to the adoption of a food-producing and agricultural economy which existed in the later neolithic about 8,000 years ago.

In two other caves in widely separated regions of Iran, which were also excavated by Dr. COON during the 1949 expedition, various human remains were found, which on preliminary examination appear to resemble Neanderthal man. These included a piece of bone from the forearm, human teeth, and a section of a human thighbone. These remains are now being studied by Dr. THEODORE MCCOWN, professor of anthropology at the University of California, Berkeley. Other remains are being studied by Dr. HENRY SETZER of the U. S. National Museum in Washington, D. C. Any final conclusions must await the results of their studies.

Dr. COON and his party have now returned to the Belt Cave in Iran to carry on the excavations begun there in 1949.

HARDLY HAD THE printer begun to compose the above, when new discoveries made by Dr. COON in April of this year, reported from Tehran by the Asso-

ciated Press on April 27 and illustrated in the May 21 issue of *Life*, almost crowded the 1949 discoveries off the stage. This season, with a staff consisting of Mrs.

COON and Mr. and Mrs. LOUIS DUPREE of Harvard, Dr. COON has been digging in the floor of a new cave known as Hotu.

The deposits here proved to be immensely thick, their upper strata showing almost continuous occupation, a complete and unbroken cultural sequence through the Iron Age, Bronze (or Copper) Age, and Neolithic or New Stone Age. Below the latter was a layer of fallen rock, debris from a collapse of the cave ceiling some time before 10,000 B.C. Below this fallen rock were layers of sands and gravels dating from the last glacial period. At a depth of 39 feet, in a deposit of hard-packed gravel, there appeared the fossilized bones of human beings.

In the May, 1951, issue of the *Bulletin of the Philadelphia Anthropological Society* appears the most authoritative statement from Professor COON available at the time of going to press, which seems to supersede earlier statements:

"In Hotu cave remains of four individuals were found in a glacial context. Considerable portions of three individuals were found, and bits of the fourth. The Pleistocene sand and gravel strata represent several successive major or minor glacial movements. Individual no. 1 was a bundle burial which Dr. Coon believes may have been cannibalized. The upper and lower jaws of this individual are heavy, and prognathism is evident. Below this find were located individuals no. 2 and 3. Remains of almost the whole of the second skeleton have been found. These latter skeletons have a more delicate bone structure, and the faces appear to be more modern than individual no. 1, which according to stratigraphic

position is of more recent date. Complete analysis of the material is necessary before anything definite can be said concerning dating of the finds. However, Dr. Coon would set 3rd interglacial as the maximum age and 15,000 B.C. as the minimum date. Analysis of the skeletal material is proceeding with the aid of Dr. J. L. Angel and Dr. Wilton M. Krogman.

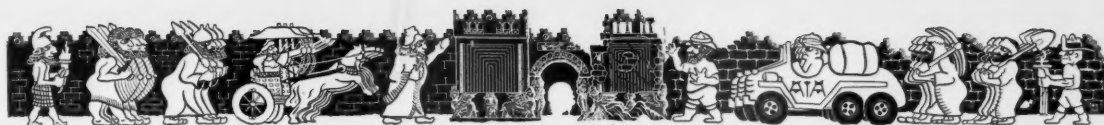
"The skeletal remains were found in association with an industry which is unusual in appearance. The majority of the artifacts belong typologically to the Acheulean of the Lower Paleolithic. A small minority of the cultural material is Gravettian, which in Europe is late Aurignacian. It is possible that some, but not all, of this later material fell into place from above.

"Another significant find in Hotu cave consists of pottery which was discovered just above the Pleistocene gravels. This Neolithic horizon is similar to that found in Belt cave. A soft, painted pottery was located in this stratum. Above it there was hard, painted pottery; this sequence continued into a thinner ware and finally into the conventional Middle Eastern type of pottery. The lower pottery level, Dr. Coon believes, represents the origin of painted pottery which accompanied agriculture in the Iranian Plateau."

If Dr. COON considers that these Caspian hillsides were particularly suited for rapid cultural advances, and that in that neighborhood was the, or a, cradle of western culture, he could hardly have made a more attractive beginning.

A query as to the origin of the name "Belt Cave" elicited the explanation that it is no more no less than a literal English translation of the Iranian name, Ghar-i-Kamarband.





# ARCHAEOLOGICAL NEWS

## *Radiocarbon Index*

After we had gone to a little trouble to compile, from newspapers, letters, and high-fidelity rumors, a listing of a dozen carbon 14 dates which we thought might specially interest archaeologists (see *ARCHAEOLOGY* 4.1. 56), we came upon a master list of results of tests performed upon a hundred and fifty archaeological specimens by the chief exponents of this method, Drs. ARNOLD and LIBBY of the Institute for Nuclear Studies, University of Chicago, Chicago, Illinois:

ARNOLD, J. R., and W. F. LIBBY, 'Radiocarbon Dates,' *Science*, Volume 113, No. 2927 (February 2, 1951), pages 111-120.

Radiocarbon dates now quoted by ARNOLD and LIBBY are based on a recently corrected value for the half-life of radiocarbon,  $5568 \pm 30$  years.

Dr. LIBBY was recently awarded a Guggenheim fellowship for further research in radiocarbon dating.

## *Guggenheim Awards*

Research fellowships announced by the Guggenheim Foundation on April 15 include at least seven of interest to Mediterranean archaeologists:

HENRI FRANKFORT, Oriental Institute, University of Chicago: The arts of the ancient Near East.

RICHARD NELSON FRYE, Harvard University: Middle Persian historical inscriptions.

WILLARD FRANK LIBBY, Institute of Nuclear Research, University of Chicago: Research into methods of historical dating by the radiocarbon content of plant and animal remains.

WILLIAM KENDRICK PRITCHETT, University of California, Berkeley: Inscriptions from the market place of ancient Athens.

LEO FRANZ SCHRADER, Yale University: History of church music from the beginning of the Christian era to the sixteenth century.

WILLIAM PITKIN WALLACE, University College, Toronto, Ont., Canada: The coinage of the ancient Greek city states.

CONSTANTINE GEORGE YAVIS, St. Louis University: Ancient Greek religious sacrifices.

## *April in Athens*

JOHN L. CASKEY, Director of the American School of Classical Studies, writes from Athens as of April 30:

Work has proceeded vigorously at the Agora. Mr. Vanderpool and Mr. Sullivan have removed a tangle of Byzantine and late Roman house walls in the northern part of the square, clearing a large unsightly area that could claim the affection of only the most determined post-Classicist. This provides broad open spaces on either side of the Panathenaic Way, where it will soon be possible to probe beneath the level of 267 A. D.

Miss Wood, still surrounded by late walls in the complicated area just south of the Temple of Ares, has come at one point upon a series of Mycenaean burials, unfortunately in sorry condition. The lines of the temple's foundations are being marked out with blocks of stone, to show the place it occupied in Roman times.

Near its north side, a Protogeometric grave has produced some interesting pottery. In the southeastern part of the square Mr. Brown is removing what is left of a tongue of high-lying ground, formerly a roadway, that runs out between the end of the Middle Stoa and the Library of Pantainos. Miss Townsend and Miss Grandjouan have been supervising the digging of ancient wells in the area of the Stoa of Attalos, and tasting both the joys and the disappointments that are ordained for well-diggers.

A number of interesting objects have been recovered and topographical information continues to accumulate. April was the first month in several years when we have been able to dig on a large scale in the Agora (apart from the Stoa of Attalos). The work has been necessarily of a preliminary character, leading toward excavation in the underlying deposits.

## *Herod at Jericho*

The American Schools of Oriental Research have announced the successful conclusion of a short dig at Jericho conducted by Professor JAMES B. PRITCHARD of Crozer Theological Seminary. The site, chosen because walls were indicated below portions of a crop of tomato plants, is southwest of a tell excavated by KELSO in 1950 and two miles from the walls of Old Jericho (now a mere shambles). Operations lasted from January 9 to March 21 and revealed the foundations of a large palace built of sandstone and containing 36 plastered and painted rooms. That it was a luxurious edifice is indicated not only by its size but by the presence of baths and mosaic floors, as well as the abundance of smaller finds. Coins date the structure to the time of Christ, and PRITCHARD believes it to be the summer palace of Herod, known from Josephus to have been located in Jericho, burnt at his death and rebuilt by his son Archelaus. By agreement with the owner of the land, the ground was filled in and is now once more raising tomatoes.

## *Life of Man on the Road*

A traveling loan exhibition of 34 paintings and 9 sculptures, depicting the life of man as seen in various countries from the tenth century B. C. to the present, has been assembled by the Metropolitan Museum of Art, New York, and shipped to Fisk University, Nashville, Tennessee, where it will be displayed for a three-month period which began on April 26. Before returning to New York, it will be exhibited at Atlanta University, Atlanta, Georgia, and at Dillard University, New Orleans, Louisiana. The costs of insurance and other incidental expenses are borne by the Carnegie Corporation. The stone sculptures include two Roman copies of Greek works and a seated scribe from Egypt. This is a thoroughly admirable activity, and for

the betterment of mankind, more large museums should do it, but oftener, and on a perhaps larger scale.

### *Tularosa Maize*

Among the amazingly preserved objects found last summer in Tularosa Cave, New Mexico, by PAUL S. MARTIN of the Chicago Natural History Museum, are about 38,000 corncobs, some entire and still bearing grains, fragments of roots, stems, and tassels. Corn from the lowest levels may be the oldest yet known; some of the ears are the most primitive kinds that have yet been unearthed. Quoting HUGH C. CUTLER, curator of economic botany, in the Chicago Museum's *Bulletin*:

There is very little variation in the oldest corn ears. Most of the ears are small and nearly of the same size and shape. The amount of variation increased and as one approached the top levels of the cave most of the kinds of corn that are grown in the same region today can be found. Here in Tularosa Cave is a history of plant breeding that covers about 3,000 years.

The story for other cultivated plants can never be so complete as that for corn. Corncobs are usually brought to the house and the grains removed there. The cobs are then discarded, usually in a refuse heap, but often they are just left about the dwellings, as was the case of the material that the Museum expedition recovered. In other plants there are few parts that are brought back to the house and then discarded. Beans, for example, are usually picked in the pod when dry, dried some more in the sun, and, after they have been flailed or trampled, winnowed in a windy spot to remove the crushed bean-pod fragments. Occasional bean seeds are lost in the refuse but this is quite rare. Thus, the rarity of bean remains, especially in the lower levels of the cave, does not mean that beans were uncommon.

Remains of squashes are usually confined to stems and fragments of the rind. Indians used the seeds as well as the fleshy parts of the squash. This is unfortunate because the principal diagnostic characters of some squashes are found in the seeds and stems. Stems are often broken off in the field and so their frequency in rubbish heaps is no indication of the amount of squash consumed.

One of the common food plants found in the lower levels of the cave was the wild gourd, *Cucurbita foetidissima*. It is closely related to the squash and still grows wild in the same region. The flesh of most of the wild gourds is bitter, al-

though there are occasional ones that can be eaten. Usually only the seeds are used, roasted, so that there is an abundance of the discarded fragments of rind with attached fibrous flesh. There are many kinds of these wild gourds, most of them used by the natives of North America for their seeds. It is likely that some of them are ancestral forms of the cultivated squashes and pumpkins. Some wild gourds are perennials and develop large starchy roots that can be eaten. Occasional fragments of a starchy root in the Tularosa Cave remains appear to be of the wild gourd.

There were fragments of the cultivated bottle gourd, *Lagenaria*, in all layers of the cave. The bottle gourd is the only cultivated plant that is known to have been cultivated in both the Old and the New World before the time of Columbus. It originated in the Old World, for there are many varieties there, and spread to the New World very early, probably by floating in the sea. While it is used here only for water jars and containers, in the Old World the young fruits are often eaten. They are rather tasteless, however, and the fact that our Indians did not eat them may be considered as evidence of the superiority of available New World foods and the discrimination of their growers.

### *Viability*

Every now and then the newspapers carry reports of the viability of plant seeds of great age—in one recent case, 50,000 years.

Most seeds die in from ten to forty years. The oldest historically dated seeds that have actually sprouted were herbarium specimens from type collections in the British Museum: during the war two seed varieties, Indian lotus and mimosa, sprouted after 150 years when bomb damage allowed rainwater to reach and saturate the packing, inadvertently providing just the right conditions for a germination test.

Any greater age claimed for germinated seeds should be received with extreme reserve.

### *Woodland and Prairie*

A new hall containing a series of 59 exhibits illustrating the culture of the Woodlands and Prairies Indians was opened at the Chicago Natural History Museum on May 1. The new hall, named Mary D. Sturges Hall in honor of a deceased benefactor of the mu-

seum, is divided evenly between Woodland and Prairie tribes.

The story of the Indians of the Woodlands and Prairies is told in terms of dioramas, idea-exhibits, and arrangement of selected specimens in carefully planned categories. In general, the idea-exhibits provide a social context for exhibits of specimens by category, and the dioramas illustrate ideas and activities that would be extremely difficult or impossible to convey by specimens alone. Various tones of green have been used as background colors for the exhibits of the Indians of the Woodlands and shades of yellow for the Indians of the Prairies. Throughout the hall there has been an effort to avoid overcrowding within the cases.

A special section of the hall is devoted to Indians of the Chicago region, which was a part of the central woodlands area. The Indians of the Chicago region were the Illinois, Miami, Potawatomi, Kickapoo, Sauk and Fox, Ottawa, Winnebago, Menominee, and southern Chippewa. Not all of these tribes occupied the area simultaneously, but all of them drifted into or out of the Chicago region in the period after A. D. 1600.

The exhibits in this section of the hall show the distribution of tribes in the Chicago region; the social organization of families, clans, bands, and tribes; types of clothing worn by men and women; types of dwellings; vegetable foods obtained by farming and gathering; preparation of food; and hunting, methods of transportation, games, art, household goods and furnishings, warfare, and religious activities.

Similar treatments are given in the exhibits to the tribes of the northern woodlands, the Iroquois tribes of the eastern woodlands, the tribes of the southern woodlands, and the Indians of the Prairies—eastern, western and southern.

### *Princeton Appointment*

Princeton University has appointed ERIK SJÖQVIST professor of Classical Archaeology, to begin in the fall. Dr. SJÖQVIST was a member of the Swedish archaeological expedition to Cyprus in 1927-1931, and director of the Swedish Institute in Rome from 1940 to 1948. In 1948-49 he was visiting professor at Princeton.

For details we turn to the April 27, 1951, number (Volume 51, No. 24) of the *Princeton Alumni Weekly*:

His appointment to the Princeton faculty, in the opinion of Professor E. Baldwin Smith, is of the greatest importance to the revival of interest in classical studies. "For a long time, and especially since the war, there has been an alarming lessening of interest in Greek and Roman art," he noted. "As a result very few young scholars are being trained to take the place of the group of classical archaeologists who are already beginning to retire.

"Hence there has been for some time the danger that this important field of humanistic studies might not be kept actively alive in the United States. If anyone can reawaken an interest in classical archaeology, it is Dr. Sjöqvist, with his personality, his command of English, his European reputation as a scholar and his distinction as a stimulating lecturer."

Professor Smith, who is chairman of the Department of Art and Archaeology, believes that, by working with the Greek archaeologists and scholars at the Institute for Advanced Study, "the University now has the opportunity of making Princeton the most distinguished center of classical study in the country."

### *Festival of Britain*

The archaeologically-minded who are in England during 1951's Festival of Britain may obtain information concerning tours to archaeological sites, excavations in progress, and museum exhibitions, by enquiring at the Council for British Archaeology, 74 Onslow Gardens, London, S. W. 7, England.

### *Books Wanted*

Ex-president STERLING DOW has come forward with a proposal to start a "Books Wanted" column. This will be done if, and as long as, readers show an inclination to use it. Please submit proper bibliographical descriptions of the book(s) you want, and your name and address. We have an anticipatory request for *The Argive Heraeum*, Volume 1, and the editor would like to obtain ARCHAEOLOGICAL NEWSLETTERS Nos. 4 and 5, items long in short supply.

### *AAA News Bulletin*

Our distinguished contemporary, the

American Anthropological Association, has appointed the new editor of the *AAA News Bulletin* for a term of three years. He is DOUGLAS OSBORNE, and he may be addressed at the Department of Anthropology, University of Washington, Seattle 5, Washington.

### *Wenner-Gren Foundation*

It was announced on February 9 that the name of the Viking Fund, philanthropic agency created and endowed in 1941 by AXEL L. WENNER-GREN to promote international research in anthropology, would shortly be changed to "Wenner-Gren Foundation for Anthropological Research." This change is now effective.

A list of recent grants by the foundation in aid of anthropological research appears in the American Anthropologi-

### THE ANCIENT AUTHOR

Accursed the scribes, who thim my  
work

Of half its sense bereft;  
But thrice accursed the editors,  
They altered what was left.

D.H.

cal Association *News Bulletin*, 5.2 (May 1951), pages 2-3.

The address of the foundation continues to be 14 East 71st St., New York, N. Y.

### *History*

The new magazine about history, to be aimed at the popular audience by the Society of American Historians, Inc. (see ARCHAEOLOGICAL NEWSLETTER 15.120, May 17, 1950), is a step nearer materialization. ALLAN NEVINS, Columbia University history professor and president of the SAH, revealed additional details in mid-May. The first issue is to appear in December; thereafter it will appear six times a year. In tribute to the permanency of the material, it will be bound in a hard cover and look like a book. Single copies will be sold at bookstores for \$2; annual subscriptions will be \$10. It will be devoted to a "lively and authoritative presentation of history," says Dr. NEVINS, with special emphasis on the historical backgrounds of current events. Authors listed as future

contributors of articles include FREDERICK LEWIS ALLEN, RALPH BUNCHE, BERNARD DE VOTO, JOHN GUNTHER, JOHN HERSEY, WALTER LIPPMANN, JOHN P. MARQUAND, and ARTHUR M. SCHLESINGER, JR.

The magazine will be called *History*.

### *Current Research*

For word of another new periodical we again owe thanks to the *AAA News Bulletin* for May. Designed to offer prompt publication of original scientific research, *Current Research* will provide services not furnished by any existing publication. The project contains so many original ideas that with your indulgence we list some of them:

Articles, limited to 1000 words, will be printed on one side of a single page. A summary title will be printed along the right-hand margin, and the inner edge of the page will be perforated to facilitate easy removal and filing.

The author will be assessed \$10 toward the publication cost of each article, which will enable the journal to expand as necessary.

There is no editorial board; any article written or sponsored by a research member of a scientific society will be published. The editor is WARE CATTELL, former editor of *Scientific Monthly*.

The scope is the entire field of science, and articles in German, French, Spanish, or English will be printed. The first issue is scheduled for October 5, 1951, and contributions are invited.

Subscriptions, at \$5 per year, may be addressed to Research Report, Inc., 1516 H Street, Washington 5, D. C.

### *Hesperia*

The price of an annual subscription to *Hesperia*, scientific quarterly published by the American School of Classical Studies at Athens and now edited by LUCY T. SHOE of the Institute for Advanced Study, Princeton, New Jersey, has been raised from \$5 to 7.50.

### *Natchez Man*

In connection with the recent re-evaluation of the fluorine content test for determining the relative antiquity of bones found in association (see ARCHAEOLOGICAL NEWSLETTER 17.129, May 3, 1951), T. D. STEWART, physical anthropologist of the Smithsonian

Institution, has pointed out (in *Science*, April 6, 1951) that a human pelvic bone, found in the last century by a Dr. N. W. DICKESON at Natchez, Mississippi, was shown by a fluorine test made in 1895 to be older than bones of the extinct giant sloth found with it, and therefore must be about 11,000 years old. If so, it is the oldest human fossil from the American continent yet described.

It was so unthinkable, in 1895, that human bones so ancient would be found in the Americas, or, if found, successfully dated, that the findings were obscured by controversy and the fluorine method itself fell into disrepute. The Natchez bone came to rest in the study collections of the Academy of Natural Sciences, Philadelphia, where it was recently located and dusted off for a triumphant return to exhibition, the hole whence the 1895 test specimen was taken still conspicuous.

#### *Summer field work*

Extensive student help will be needed in this summer's River Basin Surveys' excavations, particularly in the Missouri Valley. (See FREDERICK JOHNSON's summary in *ARCHAEOLOGY* 4.25-40.) By the time this issue reaches subscribers the season will be well advanced, but it may be not too late to apply. Write PAUL L. COOPER, Field Director, River Basin Surveys, Burnett Hall, U. of Nebraska, Lincoln 8, Nebraska.

#### *Histories of Religions*

Assisted by a grant from the Edward W. Hazen Foundation, the Committee

on the History of Religions of the American Council of Learned Societies has planned a series of manuals and translations under the general title of "The World's Religions." The first of the series, *Buddhism, a Religion of Infinite Compassion*, edited by CLARENCE H. HAMILTON of the Oberlin School of Theology, is to appear in June, followed at intervals by volumes on *Hellenistic Religions*, *Islam*, *The Ancient Near East*, *Eastern Orthodox Christianity*, *Talmudic and Medieval Judaism*, and *Ancient Roman Religion*. The publisher is the Liberal Arts Press, 153 West 72nd St., New York 23, N. Y.

#### *ASPR dig*

ASPR will excavate this autumn at the Oued Akarit near the Gabes Oasis in southern Tunisia, in cooperation with the Direction des Antiquités et Arts de Tunisie. The work will be done by Mr. BRUCE HOWE of Harvard under the director of the school, Dr. HUGH HENCKEN. In the side of the Oued Akarit, under 3 or 4 meters of sand, is a layer of clay evidently deposited by a spring. This layer of clay contains quantities of palaeolithic implements (Levallois-Mousterian) and fossil bones of extinct animals including those of rhinoceros. The site is only about five kilometers from the sea, and it is hoped that Professor CHARLES STERNS of Harvard, who will accompany the expedition as geologist, will be able to date the site in terms of former levels of the Mediterranean, of which there were many during the Pleistocene.

Also in the same region are the salt

lakes or "chotts" that once emptied into the Mediterranean but which have been cut off and made salt by an uplift along the coast. When these lakes were fresh, their shores must have been inhabited. Another aim of the expedition is to see whether such sites can be found and whether geological means exist to date them by connecting the lake deposits with Pleistocene shore lines of the Mediterranean.

[ASPR is the abbreviation of American School of Prehistoric Research whose director, HUGH HENCKEN, is also president of the ARCHAEOLOGICAL INSTITUTE OF AMERICA.—Ed.]

#### *AIA Meeting*

The 53rd General Meeting of the ARCHAEOLOGICAL INSTITUTE OF AMERICA will be held Thursday, Friday, and Saturday, December 27-29, 1951, at Princeton University, Princeton, New Jersey, in conjunction with the annual meeting of the American Philological Association. Persons wishing to read papers should submit titles and abstracts (summaries of not more than 200-300 words) to the General Secretary, Archaeological Institute of America, Andover Hall, Cambridge 38, Mass., *not later than November 15, 1951*. Abstracts should be typewritten, double-spaced, on separate sheets of paper, stylistically acceptable to the editor of the *AMERICAN JOURNAL OF ARCHAEOLOGY*. Members are reminded that the reading time for all papers is limited to 20 minutes. Announcements concerning registration and reservations will be mailed to all Members of the INSTITUTE about October 1, 1951.



## BRIEF NOTICES OF RECENT BOOKS

The Lascaux Paintings, by FERNAND WINDELS, in collaboration with ANNETTE LAMING, with a personal note by the ABBÉ HENRI BREUIL, preface by C. F. C. HAWKES, and introduction by A. LEROI-GOURHAN. 139 pages, 4 plates and map in color, 168 illustrations in monochrome, plan. Viking Press, New York 1950 \$10.00

On September 12, 1940, four boys of Montignac, Dordogne, France, entered a narrow slit in a limestone hillside on the Lascaux estate and found themselves in a vast unexplored cave whose ceilings and walls were covered with Upper Palaeolithic paintings and engravings. The indispensable ABBÉ BREUIL was summoned and arrangements were made to record and photograph them; but the troubles which were overwhelming France at that time distracted the principals and made it impossible to carry the project through to completion in an orderly fashion. A preliminary report was indeed made by BREUIL and intimations of the discovery filtered through to the outer world, but it was not until 1947 that through the editorial enterprise of *Life* colored reproductions were made widely available.

The present volume is an effort to publish, in color and monochrome, accurately and completely, a corpus of the figures. Here are a description of the cave and some comments on the artists' technique and on the fauna, and then in seemingly endless procession the Lascaux horses, oxen, bulls, cows, bison, deer, ibexes, donkeys, cats, a rhinoceros, a wolf, a bear, a bird, a 'unicorn,' a human being, and various inanimate motifs, in technically excellent photographs meticulously reproduced by gravure. The last word on Lascaux has not been said, and in fact while the ink on this volume is still fresh come rumors that additional figures have been discovered in the cave and word that radiocarbon tests indicate that the paintings are between 15,000 and 16,000 years old, somewhat younger than their sponsors first thought, and difficult to reconcile with an Aurignacian-Perigordian attribution.

And perhaps the mysterious M. WINDELS would not be the person to

have the last word in any case—there is a good deal of indirection in the remarks of MM. BREUIL, HAWKES, and LEROI-GOURHAN, and M. WINDELS seems to be most of all a photographer of exceptional talent and unusual industry; we are to assume that Mlle. LAMING shares the responsibility for the text. There is also some diffidence about the translation; Mr. HAWKES says he has taken part in its translation into English, and the dust jacket says he supervised it, but no translator is named. Yet the volume admirably performs a major function: It presents the material in such form that those who are qualified to evaluate it in terms of the history of art may do so, while the rest of us give ourselves over to the pure enjoyment of these animations dating from the early morning of the human spirit.

It would appear not reckless for a near-layman to suggest that the whole pageant will stand direct comparison with Font de Gaume and Altamira. This volume should be in every municipal, college, and museum library, and on the private shelf of every prehistorian and of every historian of art. In the meantime, M. WINDELS need feel no dismay if his book lacks finality; the analysis and interpretation of Lascaux, now but launched, will not be completed in this century.

J. J.

Troy: General Introduction. The First and Second Settlements. By CARL W. BLEGEN, JOHN L. CASKEY, MARION RAWSON, JEROME SPERLING. Vol. I. Part I, Text: xxiv, 396 pages. Part II, plates: 414 illustrations and 59 maps, plans, and sections. Princeton University Press, Princeton 1950 \$36.00

With the possible exception of Mycenae, perhaps no ancient site has exerted greater fascination over human imagination than Troy. And no other site became more instrumental in inspiring scholars to greater effort and more accurate research than the site of Hissarlik. If it was the Homeric Epic which kept alive the Trojan legend and with it the interest of our Western World, it was the personality of the discoverer and first excavator of Troy, HEINRICH

SCHLIEMANN, and his unorthodox ways which led scholars in the progressively more and more accurate study of the heroic days of the Bronze Age. SCHLIEMANN, and his assistant and successor WILHELM DÖRPFELD, in the excavations of Hissarlik, carried out in a series of seven major campaigns from 1870-1890, revealed not only the citadel of Priam, but one of the most important prehistoric sites of the northern Aegean area. Their monumental achievement, however, left a great many questions unanswered and raised new, unsuspected problems. The most pressing of these had to do with the stratigraphy of the site and the sequence of its contents. As our knowledge of the Aegean area increased, we came to realize how essential was the more accurate knowledge of the Trojan stratigraphy.

To obtain this accurate knowledge the Cincinnati University expedition, under the leadership of Professor CARL W. BLEGEN and sponsored by Professor and Mrs. WILLIAM T. SEMPLE, undertook to investigate the site again independently. Their work started in April 1932 and was brought to a successful end in 1938. It set four objectives before it: 1) to obtain "certified" material which would establish the Trojan stratification, 2) to secure any available evidence which might shed new light on the relations of Troy and the rest of the prehistoric world, 3) to locate the Trojan cemeteries which had eluded SCHLIEMANN, and 4) to explore systematically the Troad.

Objectives one and two were completely attained. Partial success was obtained in the effort to locate the Trojan cemeteries; at least one extensive cemetery, belonging to the Sixth city, was discovered and proved that cremation was prevalent in that city. The exploration of the Troad, carried out systematically, proved that no other site in that section of Asia Minor could aspire to the claim of being the Troy of Priam. In general the new excavations at Troy proved highly successful and yielded the evidence anticipated. They also provided the chance to excavate a prehistoric site of great complexity in the most perfect manner possible. For the work was carried out with exemplary

care and method and will become the model of future investigations of prehistoric sites.

The work at hand marks the beginning of the publication and contains a general introduction, explaining the method and procedures followed, and the full description and discussion of the First and Second settlements. There is scarcely any information that the scholar will require on these settlements which is not included in the volume. The material is handled by Professor BLEGEN and his collaborators in the accurate, clear, thorough, and exhaustive manner which characterizes BLEGEN's publications. Fancy interpretations, speculations and imaginative theories find no place in his work and in the scientific presentation of the material unearthed and the conclusions based upon it. The story of Troy, as far as can be learned today, emerges from this treatment clear and deprived of all uncertain and fanciful elements.

Troy I from its very beginnings, that go to ca. 3,000 B.C., was laid out as a fortified seat of mighty rulers, who built spacious, substantial houses of stone and unbaked brick. Their people used copper which they developed into bronze by the end of the life of the settlement, or by ca. 2,600 B.C. Among their other cultural achievements we should note a stele sculptured in relief, the only attempt at monumental sculpture in the Early Age of the Aegean Era uncovered thus far, which indicates the cultural ambitions of the early settlers of Troy.

Troy II passed through no fewer than eight successive stages, and its last stage was swept and destroyed by a tremendous fire. This is the settlement which was identified by SCHLIEMANN early in his excavations as the Homeric Troy on the basis of its fortification walls, its substantial houses, the traces of fire which destroyed it, and the famous treasure of Priam. To the latter the Cincinnati Excavation added 1,372 objects of gold and 5,000 other objects of metal, stone, and ivory. The final destruction of Troy II seems to have occurred long before the end of the Early Cycladic and Early Helladic Period in the Aegean Era, i.e., long before 1900 B.C.

There can be no doubt that Volume I of Troy will form a milestone in the road of research and scientific presenta-

tion of prehistoric remains. For clarity, accuracy of description and detail, and adequacy it can hardly be surpassed. It is a *klêma es aei* for which scholars the world over will be grateful to its authors. With great anticipation we shall await the appearance of the other volumes of the publication of Troy.

G. E. M.

**The Burden of Egypt.** An Interpretation of Ancient Egyptian Culture, by JOHN A. WILSON. xix, 332 pages, 32 plates. University of Chicago Press, Chicago 1951 (\$6.00)

This is a significant book. In spite of many disclaimers and a rather strained title, it is a History of Ancient Egypt. But it is a history in the modern style, which has reacted from source criticism, from meticulous establishment of fact, from "dry-as-dust" history, and places great emphasis on synthesis, generalization and the "meaning" of historical events. The influence of SPENGLER, COLLINGWOOD and TOYNBEE is today very pervasive and indeed WILSON makes specific acknowledgment of his debt to "Toynbee's enormously refreshing influence in assailing formerly fixed ideas" (page 32).

The method is quite literally by question and answer. Problems are raised and, after repeated reminders of the paucity of evidence, answers are given. How can the history of the Egyptians be written when all the thought of the Egyptians themselves was non-historical? Was isolation or accessibility the key to the early history of the Nile Valley? In the interpretation of evidence for early culture, can we be guided by such fundamental theories as TOYNBEE's *Challenge and Response*, CHILDE's *Urban Revolution*, REDFIELD's *Folk Society*? Exactly what was the concept back of the change from predynastic to dynastic? How could a rigid and static social order, if the Egyptian was that, survive so many centuries?

Questions like these form the basis of the first half of the book—the period up to the twelfth dynasty. The last half is somewhat more conventional, for the relative abundance of historical data enables us to write narrative not speculation. But WILSON's approach is essentially philosophical and he is not concerned with the writing of a text-

book. The result is a stimulating, suggestive volume which can be read with profit by the professional as well as the layman. It may even serve very usefully the objectives of the classroom if used in conjunction with a more formal outline of the "facts."

C. J. K., JR.

**Ugaritica II.** Nouvelles études relatives aux découvertes de Ras Shamra, by CLAUDE F.-A. SCHAEFFER. xv, 320 pages, 131 figures, 45 plates. Geuthner, Paris 1949 (Mission de Ras Shamra, Tome V).

The comparative archaeology of the various regions of the eastern Mediterranean area has in recent years become one of the most active and interesting fields of archaeological research. Certain sites have inevitably stood out as being of special significance in this regard, Ras Shamra above all others in the Near East. The Syrian coastal mound containing the remains of ancient Ugarit has produced quantities of objects which have proven of greatest importance in comparative studies; their value has been enhanced by rapid preliminary and final reporting. It is the fifth volume of the final publication of Ugaritic remains which now appears as *Ugaritica II*. Actually it comprises four distinct studies originally planned as separate volumes but now curtailed by the elimination of comparative material, but with no reduction in the presentation of the Ras Shamra material itself.

The first study presents two gold vessels, a patera and a shallow bowl, found together in context of about 1800 B. C., both elaborately decorated with relief designs in repoussé technique. The patera has a small central zone filled by four goats, and a wider outer zone showing a hunter-king of Ugarit chasing a gazelle and three wild bulls; the cup has three zones filled with processions and juxtaposed groups of real and fantastic animals, with a group of two hunters despatching a lion in the outer zone and many floral patterns serving as space fillers and dividers of the panels. Though quite different in style, both are local products showing strong Aegeo-Mycenaean influence and some Egyptian influence as well, typical of the eclectic art of Middle Bronze Age Syria. As the oldest known of a long series of such ves-

sels of precious metals, these occupy an especially important position, for such vessels were among the chief agents of the dissemination of Oriental art forms through the Aegean to the rest of Europe.

The long second chapter is devoted to a consideration of the wearers of metal torques, some of whom appeared at Ras Shamra about 2000 B.C. while others spread through much of prehistoric Europe. They were expert metallurgists in bronze and their metal ornament included, besides their torques, club-headed pins and bronze "bed-spring" spirals. All three appear in Europe in the Early Bronze Age and reach all the way to the Rhine by a date which SCHAEFFER believes cannot be later than 1800 B.C. The dispersal of the "torque-bearers" from Asia Minor to both Syria and Europe was accompanied by a diffusion of the knowledge of mining and metal working. About 2000 B.C. Syria became a strong center of metallurgy and in turn did much to spread this knowledge. That these makers of torques were semitized soon after their arrival in Syria is illustrated by their pantheon at Ugarit, where the

goddess Anat and the gods Aleyn-Baal and Mot are all represented on sculptured stelai which show each god wearing a torque. The same eighteenth century sanctuary which yielded the stelai also produced two statuettes of silver, a divine couple, each of whom wears a gold torque. To this same period belongs the large stele of Baal found at Ras Shamra and described in the short third chapter. It is a work of art under strong Egyptian influence, but still retaining its semitic Ugaritic character.

The last and longest section comprises the first part of the large and very important corpus of Ras Shamra pottery. All the pieces presented, largely from the middle and late phases but with some from the early phase as well, are dated by their context and therefore are the more valuable for dating similar wares elsewhere. Here the vases and sherds are presented by drawings on a series of sixty-two plates on which are grouped objects associated in tombs or other closed groups. These drawings are supplemented by some photographs in the text and many others on the last twenty-one plates.

On twenty other plates of drawings vases from different deposits are grouped by shapes. While the vases are not so spectacular as the other objects published in this volume, the assemblage of local wares, of imports from Palestine, Cyprus, Minoan Crete and the Mycenaean Aegean, and of local imitations of these imports, is far more important in giving a comprehensive view of the melting-pot of East Mediterranean art that Ugarit was in the second millennium.

As an important tool for the comparative archaeologist, the common vessel of clay holds equal place alongside the gold patera, the silver statuette and the graven stele; by their far greater number the vases become much the more significant. Every excavator of a Bronze Age site in the Aegean or the Near East will find innumerable occasions to look into this corpus of pottery from Ras Shamra; the few most fortunate will look to the gold and the sculpture for comparative material.

SAUL S. WEINBERG

*University of Missouri*

## THE BURDEN OF EGYPT *by* JOHN A. WILSON

Behind the remote and unchanging face which ancient Egyptian sculptures present to eternity, there was a lively, humorous, and intensely practical person. His culture rose with dramatic swiftness, flourished for nearly two thousand years, then hardened into a petrified formalism. His tragedy—the burden of Egypt—is difficult for the modern mind to grasp, and even in his own time was hidden in an optimistic art and religion.

From the facts of land and climate, from the symbols of art and literature, from the mythology, political beliefs and social customs, John A. Wilson, one of the world's foremost Egyptologists, has reconstructed the history of the Egyptian culture. *THE BURDEN OF EGYPT* tells the fascinating story of the intellectual, political and religious growth of the fabled peoples of the Nile, whose strong and obscure spirit animated one of the world's greatest cultures before it ultimately failed, unable to meet the challenge—unable to bear its burden.

352 pages. 32 illustrations, maps. \$6.00

THE UNIVERSITY OF CHICAGO PRESS

5750 Ellis Avenue, Chicago 37, Illinois



The Earliest Records of Christianity, by E. L. Sukenik of Hebrew University, Jerusalem. A Special Reprint from the *American Journal of Archaeology*, Volume 51 (1947). Price: 50 cents each. Order from the

ARCHAEOLOGICAL INSTITUTE OF AMERICA, ANDOVER HALL, CAMBRIDGE 38, MASS.

Excavations at Nessana, Vol. 2. *Literary Papyri*, by LIONEL CASSON and ERNEST L. HETTICH. xiv, 175 pages, 8 plates. Princeton University Press, Princeton 1950 \$7.50

Of three volumes which will give a complete report of the work of the Colt Archaeological Expedition at the site of the ancient village of Nessana, modern Auja el-Hafir in southern Palestine, the edition of the *Literary Papyri* is first to appear. Its handsome format and the excellent scholarship exhibited in the editing of the texts give every evidence of a series of first rank.

The literary pieces are thirteen in number, twelve written on papyri, one on vellum. Each text is accompanied by an ample introduction, commentary, and critical notes. Number 1, the largest and likewise the most important, is a Latin-Greek Glossary of the *Aeneid*, probably written in the latter half of the sixth century. When complete the glossary began at book I and continued at least through book IV. Portions of books I, II, and IV—a total of 1025 lines—are preserved. Each page of the original codex contained two columns, that on the left listing words of the Latin text, that on the right a Greek translation of each. In the extant portions covering books I and II every word of the Vergilian text is listed and translated; the section preserved from book IV contains selected words only, but the criterion used in making the selection is not apparent.

The importance of this codex is emphasized by the care that has been taken in presenting the essential information concerning it, i.e., its structure, date, ancestry, errors, etc. The editors are to be complimented highly

for making this material readable; it lacks the "stiffness" too often characteristic of such presentations of facts.

The other texts are (2) Fragments of *Aeneid* II-VI, possibly of the sixth century; (3) Fragments of the Gospel of John, seventh century; (4) John XVI.29—XIX.26, seventh-eighth century; (5) Fragments of the Pauline Epistles, seventh-eighth century; (6) Acts of St. George, seventh-eighth century; (7) Letter of Abgar to Christ and Christ's Reply, sixth-seventh century; (8) Greek Glossary, seventh century; (9) The Twelve Chapters on Faith, seventh century; (10) Theological Fragments, seventh century (possibly a homily on the fourth chapter of Genesis); (11) Legal Fragment, sixth century; (12) Legal Fragment, seventh century; (13) Theological Fragment, late seventh century (written on vellum).

Indexes and eight excellent plates conclude the volume.

VERNE B. SCHUMAN

Indiana University

The Funk & Wagnalls Standard Dictionary of Folklore, Mythology, and Legend. Volume 2: J-Z, edited by MARIA LEACH and JEROME FRIED. Pages 532-1196, tables. Funk & Wagnalls, New York 1950 \$7.50 Volumes 1 and 2, boxed, \$15.00

The publication of Volume 2 completes the dictionary proper of this important project. There still remains an index volume, announced for the fall of 1951, which will be indispensable for the full use of a dictionary that in its sweeping scope of areas and subjects and in complexity of handling its folk entries is reminiscent of the *Motif-Index of Folk-Literature*. The present alphabetical catalogue, embracing folklore

and legend in the widest possible acceptances of those terms, is a bold and highly laudable undertaking. These volumes will be a boon and delight to lovers of all the arts.

One regrettable editorial decision detracts from the value of the work: the most important category—classical folklore and mythology—has been given shoddy treatment. For these the dictionary is far from adequate. The defense expressed in the preface that the classical field is already well covered is a specious excuse for not assigning a classical scholar to the task of organizing the classical material and maintaining a consistent policy. The results are seen in the omission of such important articles as Paean, Palamedes, Pales, Palladium, Pallas, Pandarus, Pantheon, Parcae, Parnassus, Parthenos (-on), Pasiphae, and Patroclus from the beginning of the letter P. Even less excusable is the inconsistency: Anthesia and Thesmophoria are in, Diasia and Panathenaea out; Gyes in, Briareus out; Polyidus in, Minos and Glaucus out; Polynices in, Laius out; Latinus in, Lavinia and Turnus out; Ovid in, Pliny, the most important ancient folk source, out. MANNHARDT and MULLENHOFF are included, but not COOK, MARETT, and WARDE FOWLER; SALOMON REINACH is in, but not SCHLIEMANN and EVANS. The editors have missed a fine opportunity to bring the classical material up to date in an authoritative reference work.

WILLIAM H. STAHL

New York University

The Pottery of Marajo Island, Brazil, by HELEN C. PALMATARY. Pages 261-470, 112 plates, 4 figures, 2 maps, 1 chart, appendix, bibliography. Philadelphia 1950 (Transactions of the American



Philosophical Society, New Series, Volume 39, Part 3) \$3.00

On a map of South America Marajó Island is often seen as a large egg in the mouth of the gigantic, serpentine Amazon. Marajó, a relatively tiny part of Brazil, has, archaeologically speaking, produced some of the finest and most spectacular pre-Columbian ceramics in the New World. For almost a hundred years, scientists and explorers have taken from Marajó the several-century-old treasures of pottery, rivaling any in the western hemisphere. Today, the finest specimens of Marajó pottery are housed in museums and private collections throughout the world, and it has been Miss PALMATARY's privilege to study much of this material. In her research she has analyzed over 5,000 specimens in eight American, one Brazilian, and two Italian collections, roughly one-half of the important extant Marajoan collections. Here she presents the results, along with excellent photographs of exemplary products of Marajoan fictile arts.

In her monograph, Miss PALMATARY, Research Assistant in Brazilian Studies at the University of Pennsylvania Museum, first gives an excellent discussion

of the geography and history, and sketches the course of archaeological work on Marajó Island. She then classifies and describes the pottery studied, including the distinctive, anthropomorphic, burial urns, the *tangas* or female pubic coverings, human figurines, and shoe-shaped vessels, as well as the more common plates, bowls, jars, and bottles. Decoration, a criterion of prime importance in the PALMATARY classification, is varied, with incised and engraved designs, champlévé, and painting (monochrome, dichrome, and polychrome) constituting interesting and important types. A rather large number of pottery pieces are dealt with clearly and concisely.

Finally, the author compares Marajoan pottery with pottery from other areas in North and South America. Her thesis is provocative, and she looks to such places as Venezuela, Columbia, and Panama, and to the southeastern part of the United States, for similarities in pottery decoration and form which may bespeak cultural connections. Many readers will probably be impressed by some of these similarities, but the question is to what extent they are culturally valid and not fortuitous.

This Miss PALMATARY does not prove beyond doubt.

The chronological position of the highly decorated Marajoan pottery is still uncertain because of the absence of extensive stratigraphic studies on Marajó. The spectacular material has always attracted the most attention, although plainer, less elaborate kinds of pottery are known, and there is indication that some of the latter succeeded the former on the island. Current opinion, not developed in PALMATARY's primarily typological treatise, favors the hypothesis that the makers of the richer pottery were agriculturists, with a fairly complex social organization, who migrated to Marajó from the mainland of South America. The island ambient being somewhat less favorable to successful farming, the economy of the group gradually changed to a less substantial one, with a resulting deterioration in certain aspects of the culture, notably ceramics. This putative development would have taken place in pre-Conquest times; just how many centuries before the coming of the Europeans, however, remains to be seen.

JAMES B. WATSON

Washington University

---

## TWO NEW BOOKS IN ARCHAEOLOGY FROM THE UNIVERSITY OF CALIFORNIA PRESS

---

### Poggio Buco

THE NECROPOLIS OF STATONIA

by **Giacinto Matteucig**. A full description of the contents of seven Etruscan tombs. Matteucig describes the 300 vases in detail, considers their chronology and geographical distribution, discusses techniques, and introduces parallel material for comparison. 132 pages, 2 maps, 24 plates \$4.00

### Han Tomb Art of West China

A COLLECTION OF FIRST- AND SECOND-CENTURY RELIEFS

by **Richard C. Rudolph in Collaboration with Wen Yu**. The early archaeology of Szechwan Province as shown in one hundred reliefs in stone and clay dating from the Later Han Dynasty (25-220 A.D.). This material has never been available before in the West. The Introduction outlines the early archaeology of Szechwan, describes types of cave-tombs, and reviews important recent finds. 148 pages, 100 collotypes, map \$8.50

at your bookstore

UNIVERSITY OF CALIFORNIA PRESS  
Berkeley 4, California

## NEW BOOKS

Selected at the editorial offices from various sources, including bibliographical publications, publishers' announcements, and books received. Prices have not been confirmed.

ABELSON, PAUL. *The Seven Liberal Arts. A Study in Medieval Culture.* 150 pages. Peter Smith, New York 1950 \$2.50

ANGEL, J. LAWRENCE. *Troy. The Human Remains. Supplementary Monograph 1.* 40 pages, 14 plates, 8 tables. Princeton University Press, Princeton 1951 \$7.50

BEARE, WILLIAM. *The Roman Stage. A Short History of the Latin Drama in the Time of the Republic.* xii, 292 pages, ill. Methuen, London 1950 25s.

BENNYHOFF, J. A. *Californian Fish Spears and Harpoons.* 46 pages. University of California Press, Berkeley 1950 \$0.75

BLACKWOOD, BEATRICE. *The Technology of a Modern Stone Age People in New Guinea.* 60 pages, 16 plates. Pitt Rivers Museum, Oxford University, Oxford 1950 (Occasional Papers on Technology, No. 3) 10s. 6d.

BUKOFZER, MANFRED F. *Studies in Medieval and Renaissance Music.* 324 pages, 7 plates. W. W. Norton, New York (1950) \$6.00

CAIN, H. THOMAS. *Petroglyphs of Central Washington.* 57 pages, ill. University of Washington Press, Seattle \$1.00

CANALS, FRAU SALVADOR. *Prehistoria de América.* 588 pages, 118 figures, 12 plates. Editorial Sudamericana, Buenos Aires 1950 \$50. m/arg.

CHADWICK and W. N. MANN, Editors. *Hippocrates, The Medical Works.* vii, 301 pages. Blackwell Scientific Publications, Oxford 1950 20s.

COON, CARLETON S. *The Mountain of Giants. A Racial and Cultural Study of the North Albanian Ghegs.* viii, 105 pages, 16 plates, 7 figures in text, 28 tables. Peabody Museum, Cambridge 1950 (Papers of the Peabody Museum of American Archaeology and Ethnology, 23.3)

COON, CARLETON S., STANLEY M. GARN, and JOSEPH B. BIRDSELL. *Races, A Study of the Problems of Race Formation in Man.* xiv, 153 pages, 11 figs., 15 plates. Charles C. Thomas, Springfield 1950 \$3.00

CORTI, EGON CAESAR. *The Destruction and Resurrection of Pompeii and Herculaneum; translated from the German by K. and R. GREGOR SMITH.* x, 220 pages, plates. Routledge and K. Paul, London 25s.

DAVISON, DOROTHY. *The Story of Prehistoric Civilizations.* xiii, 266 pages, ill., maps, tables. Watts, London 1951 12s. 6d.

DUNHAM, DOWS. *El Kurru, The Royal Cemeteries of Kush. Volume 1.* 245 pages, ill., 73 plates, 2 charts, 2 maps. Harvard University Press, Cambridge 1951 \$25.00

FERM, VERGILIUS, Ed. *Forgotten Religions.* xv, 392 pages. Philosophical Library, New York 1950 \$7.50

FRANK, EDGAR B. *Old French Ironwork; the Craftsman and his Art.* 221 pages, 96 plates. Harvard University Press, Cambridge 1950 \$6.00

HADAS, MOSES, Ed. and tr. *Aristeas to Philocrates. (Letter to Aristeas).* A bilingual edition with notes and introductory commentary. 240 pages. Harper, New York 1951 \$4.00

HARVEY, JOHN HOOPER. *The Gothic World, 1100-1600. A Survey of Architecture and Art.* 172 pages, ill., maps. Batsford, New York 1951 \$6.00

HEIDEL, ALEXANDER. *The Babylonian Genesis. The Story of the Creation. Second Edition.* 168 pages, ill. University of Chicago Press 1951 \$3.50

JENNINGS, JESSE D., Ed. *Proceedings of the Sixth Plains Archaeological Conference (1948).* viii, 161 pages, figs. in text, 5 plates. University of Utah Press, Salt Lake City (Anthropological Papers No. 11, October 1950)

KITTO, HUMPHREY DAVY FINDLEY. *The Greeks.* 256 pages. Penguin Books, Harmondsworth 1951 1s. 6d.

KUBLER, GEORGE and CHARLES GIBSON. *The Tovar Calendar. An Illustrated Mexican Manuscript ca. 1585.* 82 pages, 14 plates. Connecticut Academy of Arts and Sciences, New Haven 1951 (Memoirs of the Connecticut Academy of Arts and Sciences, Vol. XI) \$6.00

LEROI-GOURHAN, ANDRÉ. *Les fouilles préhistoriques. Technique et méthodes.* vii, 88 pages, 10 plates. Éditions A. et J. Picard, Paris 1950

LEWIS, BERNARD. *The Arabs in History.* 196 pages, maps. (Longman's), New York 1950 \$1.60

LORIMER, HILDA LOCKHART. *Homer and the Monuments.* xxiii, 552 pages, ill. Macmillan, London 1951 60s.

MAKEMSON, MAUD WORCESTER. *The Book of the Jaguar Priest. A translation of the Book of Chilam, Balam of Tizim, with commentary.* xi, 238 pages. Henry Schuman, New York 1951 \$3.50

MILES, GEORGE C. *The Coinage of the Umayyads of Spain.* 2 parts, xi, 590 pages, 15 plates. The American Numismatic Society, New York 1950 (Hispanic Numismatic Series, Monograph No. 1) \$10.00

MINER, HORACE MITCHELL. *Cave Hollow, an Ozark Bluff-dweller Site.* 12 pages. University of Michigan Press, Ann Arbor 1950 \$0.50

MITCHELL, S. R. *Stone-Age Craftsmen. Stone Tools and Camping Places of the Australian Aborigines.* 211 pages, 45 figures, 16 plates. Tait Book Co., Melbourne 1949 (Stechert-Hafner, New York) 27s. 6d.

NOE, SYDNEY P. *The Alexander Coinage of Sicyon. Arranged from Notes of EDWARD T. NEWELL with Comments and Additions.* 41 pages, 18 plates. The American Numismatic Society, New York 1950 \$3.50

OSBORNE, CAROLYN M. *Shaped Breechcloths from Peru.* 41 pages. University of California Press, Berkeley (1950) \$0.50

PAYNE, HUMFRY, and GERARD MACKWORTH-YOUNG. *Archaic Marble Sculpture from the Acropolis. A photographic catalogue.* Revised edition. xv, 79 pages, 140 plates. Cresset, London 1951 63s.

ROBINSON, CHARLES ALEXANDER, JR. *Ancient History, from Prehistoric Times to Death of Justinian.* xxiii, 738 pages, 138 illustrations, 83 maps and diagrams. Macmillan Co., New York 1951 \$6.00

RUDY, JACK R., and ROBERT D. STIRLAND. *An Archaeological Reconnaissance in Washington County, Utah, 1949.* iii, 66 pages, figures in text, 9 plates. University of Utah Press, Salt Lake City (Anthropological Papers No. 9, April 1950)

SCULLARD, HOWARD HAYES. *Roman Politics, 220-150 B.C.* xvi, 325 pages, diagrs. Clarendon Press, Oxford 1951 30s.

SIGERIST, HENRY E. *A History of Medicine. Volume I. Primitive and Archaic Medicine.* xxi, 564 pages, 48 plates. Oxford University Press, New York 1951 \$8.50

SOKOLOV, Y. M. *Russian Folklore. Translated by CATHERINE RUTH SMITH.* 760 pages. Macmillan, New York 1950 \$10.00

THOMPSON, R. C. *A Dictionary of Assyrian Botany.* 420 pages. Oxford Press, New York 1950 \$3.50

\*WILSON, JOHN A. *The Burden of Egypt. An Interpretation of Ancient Egyptian Culture.* xix, 332 pages, 73 illustrations. University of Chicago Press, Chicago 1951 \$6.00

\* Reviewed above, page 124.



*Just Published*

## INDEX to the ART BULLETIN

Volumes I-XXX—1913-1948

Analyzed by artists, works of art, collections, museums, periods, styles, iconographic themes, and many other topics.

A working tool in all fields of artistic activity, indispensable to the research of scholars, curators, teachers, dealers, librarians, critics, and practising artists.

Prepared by Rosalie B. Green

Handsomely printed and cloth bound—Shelf size of the ART BULLETIN  
425 pages—over 50,000 entries

\$12 to members—\$15 to non-members

*Published by*

THE COLLEGE ART ASSOCIATION OF AMERICA AND THE INDEX-SOCIETY

*Orders and inquiries should be addressed to*

**Index Society, Harold W. Bentley, Secy., 101 Library, University of Utah,  
Salt Lake City, Utah**

## THE MEDIAEVAL ACADEMY OF AMERICA

was founded in Boston in 1925 and incorporated under the laws of the Commonwealth of Massachusetts "to conduct, encourage, promote and support research, publication, and instruction in mediaeval records, literature, languages, arts, archaeology, history, philosophy, science, life and all other aspects of mediaeval civilization by publications, by research, and by such other means as may be desirable, and to hold property for such purpose." Membership in the Academy is open to all persons interested in mediaeval studies.

SPECULUM, published quarterly since 1926 by the Mediaeval Academy of America, presents articles and reviews concerned with mediaeval architecture, armor, fine arts, geography, heraldry, law, literature, music, numismatics, philosophy, science, and social and economic institutions of the Middle Ages.

### THE MEDIAEVAL ACADEMY OF AMERICA

1490 MASSACHUSETTS AVENUE, CAMBRIDGE 38, MASSACHUSETTS

Princeton  
UNIVERSITY PRESS



---

# THE Pylos Tablets

By EMMETT L. BENNETT, Jr.

TRANSCRIPTIONS of the texts inscribed on hundreds of clay tablets uncovered in 1939 at a site north of Pylos in western Messenia. The excavations were conducted by the late Dr. K. Kourouniotis of the National Museum, Athens, and Professor Carl W. Blegen.

*Published for the University of Cincinnati. \$2.00*

---

# THE Human Remains from Troy

TROY SUPPLEMENTARY MONOGRAPH I

By J. LAWRENCE ANGEL

A COMPLETE description and analysis of the human skulls and skeletons, from prehistoric as well as historic times, found in the excavations at Troy.

*Published for the University of Cincinnati. \$7.50*

---

At your bookstore PRINCETON University Press



